

# *Carex plantaginea*

Plantain-leaf Sedge

Cyperaceae



*Carex plantaginea* by Katy Chayka, 2017

## ***Carex plantaginea* 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

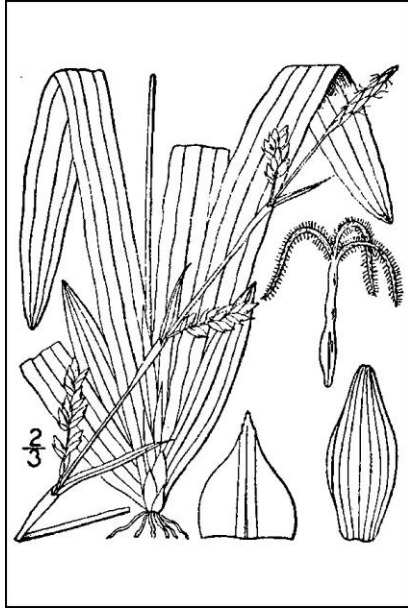
*Carex plantaginea* (Plantain-leaf Sedge) is an evergreen forest herb in the Cyperaceae. *Carex* is a large genus that has been divided into subsections, and *C. plantaginea* has been placed in Section Careyanae. The group includes sedges with staminate terminal spikes and loosely-flowered carpellate spikes bearing distinctly veined perigynia that taper at both ends and terminate in short beaks (Arsenault et al. 2013, Bryson and Naczi 2020). *Carex plantaginea* has a number of features that help to distinguish it from similar species: The leaves are wrinkled and wide (8–32 mm) with red-purple sheaths at the base, and the flowering culms lack leaf blades but have reddish bract sheaths at intervals along the green stems that give them a banded appearance (Arsenault et al. 2013, Hilty 2020, Kirschbaum undated).



Left: Basal sheaths by Peter M. Dziuk, 2016. Right: Bract sheaths by John Hilty, Illinois Wildflowers (undated).

*Carex plantaginea* reproduces clonally via short rhizomes, causing the plants to grow in dense tufts. New clones develop on pseudoculms—very short stems with leaf clusters at the tips—and in *C. plantaginea* those stems are so small that the vegetative shoots appear to be rosettes (Reznicek and Catling 1986). The modular growth of *Carex* allows for the production of multiple units (ramets), but ramet mortality is frequently high depending on local conditions (Bernard 1990). A typical *C. plantaginea* plant has two types of buds: The primary bud produces a central leafy shoot while lateral buds that develop at its base can become flowering stems (Holm 1896). In most *Carex* species, the shoots of next year's flowering stems are initiated during the autumn months. The evergreen leaves of *C. plantaginea* allow the sedge's growth to continue throughout the latter part of the fall and recommence early in spring before leaf emergence (Bernard 1990). Bernard noted that the strategy may also permit the storage of additional energy when winter conditions are favorable. Leaves that have overwintered can appear shriveled or dead at the tips (Kirschbaum undated) and new leaves are produced just after flowering (Bierzychudek 1982). *C. plantaginea* has fibrous roots, and no reports of mycorrhizal associations were found. Although there are exceptions, the majority of *Carex* species are non-mycorrhizal (Miller et al. 1999).





Left: Britton and Brown 1913, courtesy USDA NRCS 2022a. Right: Wrinkled leaves by John Hilty, Illinois Wildflowers (undated).

The flowering culms of Plantain-leaf Sedge are triangular, rough on the edges, and 24–54 cm high. The terminal staminate spike is elevated on a long peduncle, purplish in color, and has conspicuous anthers. The stalks of the 2–4 lateral pistillate spikes are mostly concealed behind the reddish bracts, and the lowest is on a basal peduncle up to 2 cm in length. Each pistillate spike has 9–15 perigynia which are elliptic, finely veined, and terminate in short beaks that can be straight but often curve. (See Britton and Brown 1913, Fernald 1950, Gleason and Cronquist 1991, Arsenault et al. 2013, Bryson and Naczi 2020).



Flowering culms with purple staminate spikes (left) and close-up of perigynia (right), photos courtesy of James L. Reveal, Lady Bird Johnson Wildflower Center.

Flowering time for *Carex plantaginea* has been reported as mid-spring (Weakley 2015, Hilty 2020) and is concurrent with spring ephemerals (Arsenault et al. 2013). A study at a North Carolina site reported that *C. plantaginea* has shown a significant trend of flowering earlier over time and cited an average bloom date of March 6 for the sedge, although no correlation was found between flowering time and mid-winter or spring temperatures (Pitillo and Collins 2010).

## **Pollinator Dynamics**

*Carex* plants are wind-pollinated and self-compatibility is common in the genus, although the probability of cross-fertilization is enhanced by the female flowers becoming receptive before staminate flowers on the same plant release their pollen (Bertin 2007). Greenhouse studies have demonstrated that *Carex plantaginea* is self-compatible and that self-fertilization results in high seed set (Handel 1978a). Friedman and Barrett (2009) reported an 82% seed set in open-pollinated *C. plantaginea* plants. They also found high levels of outcrossing in the species, observing that the removal of staminate spikes did not reduce the rate of pollen capture by pistillate flowers on the same plants.

## **Seed Dispersal**

*Carex* fruits are single-seeded achenes, and those of *C. plantaginea* are ovoid, sharply three-sided, and have no elaiosomes (Bryson and Naczi 2020, Gleason and Cronquist 1991, Handel 1976). The fruits of *Carex plantaginea* mature during the spring (Bryson and Naczi 2020) and the plants release their seeds in June (Velland et al. 2000a). The primary dispersal mechanism for the sedge is gravity (Velland et al. 2000a, Bellemare et al. 2002), and Handel (1976) noted that *C. plantaginea* seeds generally travel no further than the length of a fallen fertile stem. Handel also observed that ants seeking the elaiosome-bearing seeds of *Carex pedunculata* would occasionally pick up a *C. plantaginea* seed and move it for a few centimeters before losing interest and dropping it. Mammalian herbivory on fertile culms of *C. plantaginea* has been reported (Kirschbaum undated) and Myers et al. (2004) found that viable sedge seeds (*Carex spp.*) may occasionally be dispersed by white-tailed deer (*Odocoileus virginianus*), suggesting a potential mechanism for dispersal over longer distances.

Once dispersed, *Carex plantaginea* seeds do not germinate until the following May or June. Handel (1978b) found that the propagules required a period of cold stratification to fully develop, and seeds which were maintained at a constant temperature in a growth chamber failed to germinate. Low germination rates have been cited for *C. plantaginea*, ranging from 3 or 4% to 21.8% in various studies (Velland et al. 2000b, Handel 1978b). Following a greenhouse germination experiment with multiple *Carex* species, Bond (1999) indicated that fewer than 10% of *C. plantaginea* seeds germinated in any treatment and seedlings of the species died before the plants became large enough to make voucher specimens. Seed banking has been documented for Plantain-leaf Sedge at a density of up to 150 seeds per square meter, but the length of time that the seeds can remain viable was not reported (Leckie et al. 2000).

## **Habitat**

*Carex plantaginea* is a denizen of rich deciduous or mixed forests, where it may be found at elevations of 100–600 meters (Bryson and Naczi 2020). The substrate may be calcareous or mafic (Oosting 1941, Weakley 2015) and the habitats are often described as slopes, ravines, or gorges (Rhoads and Block 2007, Hilty 2020).

Although it is characterized as an upland species (see next section), *C. plantaginea* requires a moist substrate. Cited habitats include poorly drained areas at the bottom of ravines (Handel 1978b) or moist depressions and creek edges (Friedman and Barrett 2009), and the sedge's preference was described by Velland et al. (2000a) as "the wet end of a xeric-mesic moisture gradient." In addition to moisture, microsite characteristics noted as important by Velland et al. (2000a) were nitrate-rich soils and a cover of leaf litter. Warren (2009) indicated that *C. plantaginea* was most likely to occur on cool north-facing slopes with limited winter light, and suggested that the plants may benefit from high soil moisture combined with low temperatures in summer and/or low light combined with warmer temperatures in winter. New Jersey's sole occurrence was found in rich, moist woods on a rocky west-facing slope (Snyder 1985).

One plant community association where the sedge may be found is Sugar Maple—Ash—Basswood Rich Mesic Forest, a habitat type that is uncommon in New Jersey (Breden et al. 2001). Canopies dominated by Sugar Maple (*Acer saccharum*) and beech (*Fagus grandifolia*) were reported as characteristic habitat for Plantain-leaf Sedge by Bond (1999) and Velland et al. (2000a), while Arsenault et al. (2013) noted that the species was often associated with Basswood (*Tilia*). Hilty (2020) mentioned that *C. plantaginea* was frequently found growing with ferns.

### **Wetland Indicator Status**

*Carex plantaginea* is not included on the National Wetlands Plant List (NWPL). Any species not on the NWPL is considered to be Upland (UPL) in all regions where it occurs. The UPL designation means that it almost never occurs in wetlands (U. S. Army Corps of Engineers 2020).

### **USDA Plants Code (USDA, NRCS 2022b)**

CAPL4

### **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 plantaginea* is restricted to eastern and central Canada and the United States (POWO 2022). The map in Figure 1 depicts the extent of the species in North America. Although the map indicates that the Manitoba record is questionable, Plantain-leaf Sedge has also been reported from Saskatchewan (Ledingham and Fraser 1943).

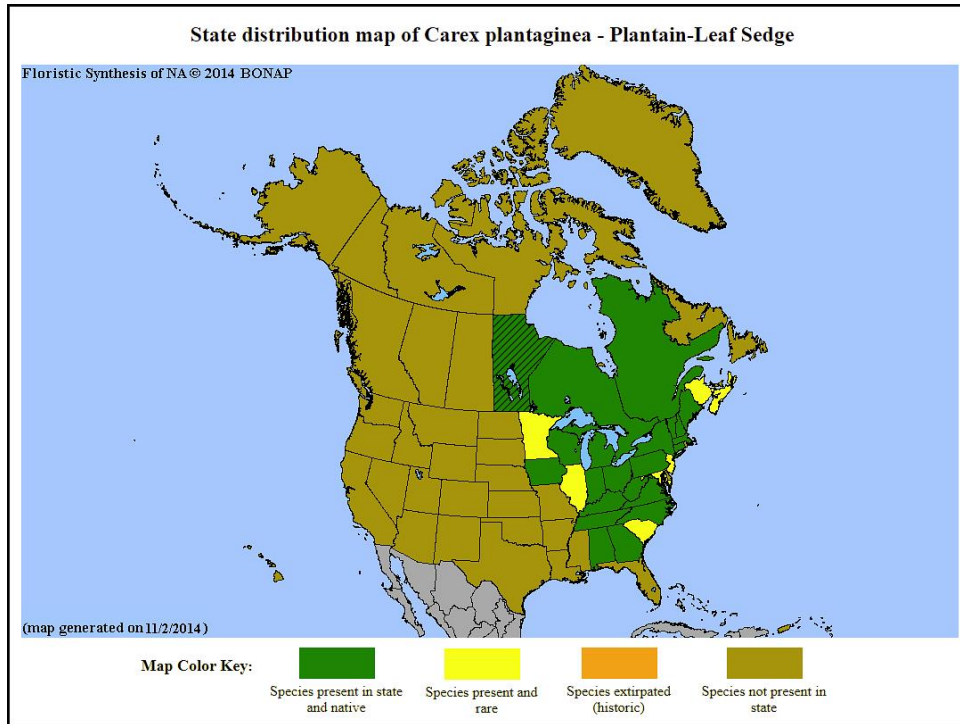


Figure 1. Distribution of *C. plantaginea* in North America, adapted from BONAP (Kartesz 2015). Cross hatching /// indicates a questionable presence.

The USDA PLANTS Database (2022b) shows New Jersey records of *Carex plantaginea* only in Warren county (Figure 2). The map reflects the current known distribution of the species.

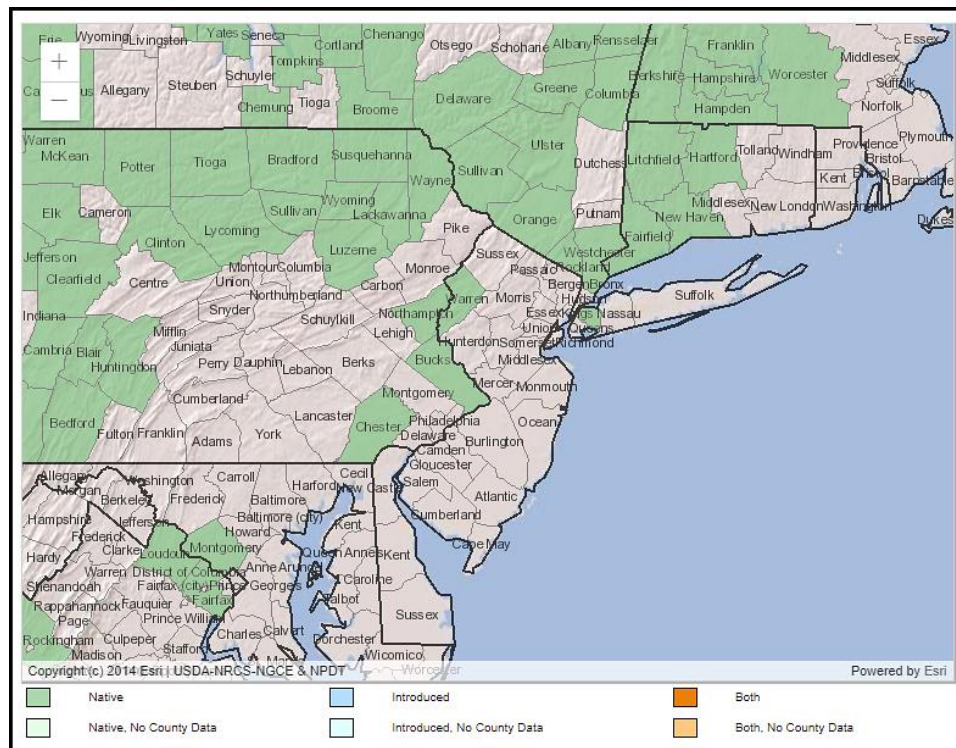
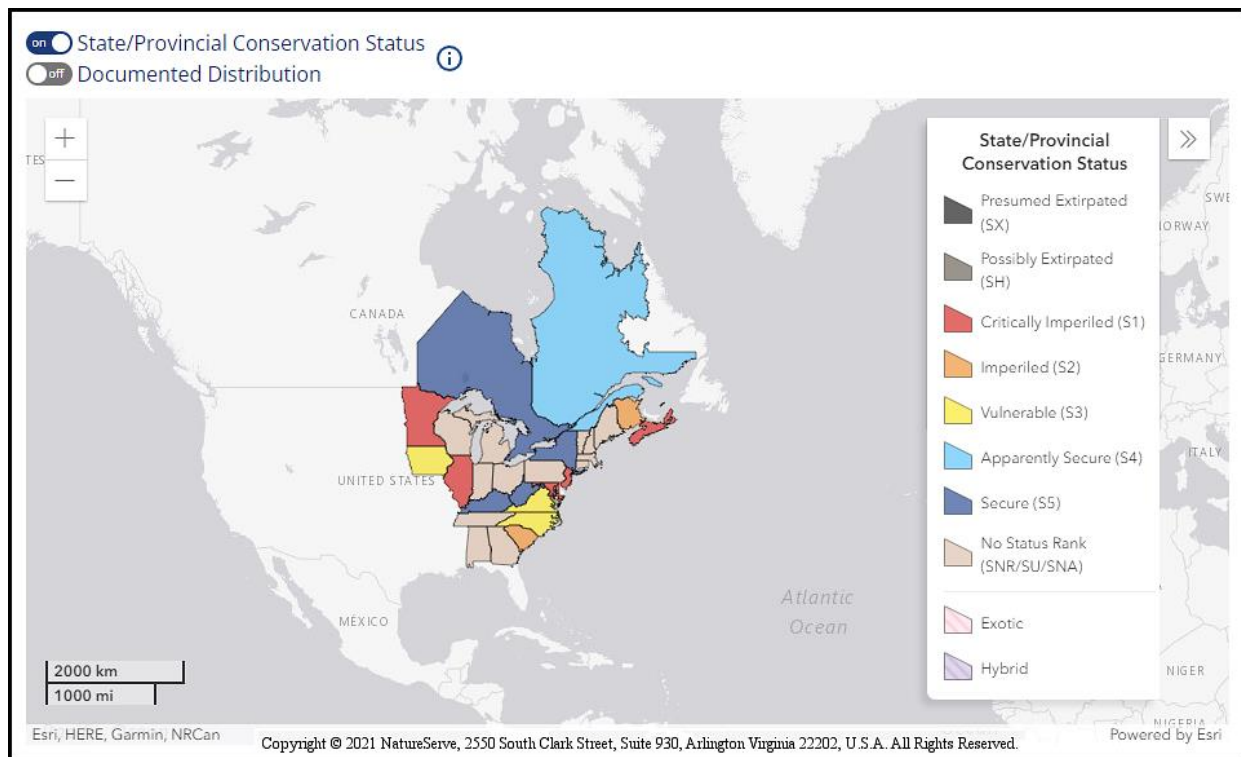


Figure 2. County records of *C. plantaginea* in New Jersey and vicinity (USDA NRCS 2022b).



## Conservation Status

*Carex plantaginea* is considered globally secure. The G5 rank means the species has a very low risk of extinction or collapse due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats (NatureServe 2022). The map in Figure 3 illustrates the conservation status of *C. plantaginea* throughout its range. Plantain-leaf Sedge is critically imperiled (very high risk of extinction) in four states and one province, imperiled (high risk of extinction) in one state and one province, and vulnerable (moderate risk of extinction) in three states. Throughout the majority of its range, *C. plantaginea* is unranked or considered secure or apparently secure.



*Carex plantaginea* is ranked S1.1 in New Jersey (NJNHP 2022), meaning that it is critically imperiled due to extreme rarity. A species with an S1.1 rank has only ever been documented at a single location in the state. *C. plantaginea* 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 Plantain-leaf 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). New Jersey's only record of the sedge was the result of a discovery by David Snyder in 1984 (Snyder 1985), and the population is still extant (NJNHP 2022).



## Threats

Herbivory appears to be the most immediate threat to *Carex plantaginea* in New Jersey, as heavy deer (*Odocoileus virginianus*) browse was observed during the most recent monitoring visit to the state's sole population (NJNHP 2022). Kirschbaum (undated) observed that both deer and rabbits consume the plant's fertile culms and suggested that the early blooming of the species makes it particularly vulnerable to browsing since alternative food sources are often limited during that time period. Removal of stems prior to the completion of fruit development would obviously hinder sexual reproduction. The evergreen leaves of *C. plantaginea* can also make the species more susceptible to winter herbivory. Bison (*Bison bison*) in northern Canada rely on the shoots of various *Carex spp.* for as much as 70–80% of their winter diet (Bernard 1990). In New Jersey, deer browse on another herb with evergreen leaves (*Helonias bullata*) is most intense during the winter months and repeated incidents deplete the plants' stored resources—ultimately reducing vigor, clonal reproduction, and survival (personal observation).

As with many upland species, the habitat of *Carex plantaginea* can frequently be destroyed or fragmented during the pursuit of various commercial, agricultural, or recreational activities (Smith 2020). Some forest management practices may also threaten Plantain-leaf Sedge (NatureServe 2022). Smith (2020) specified that practices which reduce canopy cover can in turn cause soils to become drier, making sites unsuitable for plants that require a mesic environment, and additionally noted that the use of heavy machinery can trigger erosion.

Many upland habitats in New Jersey have been degraded by an overabundance of non-native invasive plants, creating and/or compounding threats to rare indigenous species (NJDSR 2021). In another part of the country, Garlic Mustard (*Alliaria petiolata*) and buckthorn have been cited as threats to *C. plantaginea* (Minnesota Wildflowers undated). Buckthorn may refer to either *Rhamnus cathartica* or *Frangula alnus*; both are reported as threats to native communities in Minnesota (MNDNR 2022).

*Carex plantaginea* may be threatened by introduced earthworms that destroy the organic soil layer (Minnesota Wildflowers undated). Corio et al. (2009) examined the impact of earthworms on the flora of forests in the Great Lakes region. Although *C. plantaginea* was growing in the study area it was excluded from the analysis due to a limited presence. However, in places where earthworms were abundant enough to reduce the litter layer a significant decrease in sugar maple seedlings was found and the cause was attributed to loss of soil moisture. Based on the habitat requirements of *C. plantaginea*, it is likely that reduced moisture would also have a negative effect on the sedge.

A high level of rosette mortality was observed in the New Jersey population of Plantain-leaf Sedge following a prolonged period of extreme high temperatures during 2010 (NJNHP 2022). Velland et al. (2000a) proposed that the distribution of *Carex plantaginea* has been shaped by its requirement for high soil moisture and a lack of tolerance for drier conditions. Evergreen understory herbs like *C. plantaginea* which prefer cooler, moister north-facing slopes over southern exposures will likely be vulnerable to climate change, particularly in places where warmer temperatures result in drier conditions or extended periods of drought (Warren 2009).

## **Management Summary and Recommendations**

In places where the species is imperiled, some occurrences of *Carex plantaginea* may benefit from habitat conservation. Smith (2020) recommended the establishment of a buffer area around populations in which only minimal activity is permitted. In New Jersey, strategies for reducing deer impacts should be explored, as continuous herbivory is likely to limit the sedge's survival and reproductive success. The use of deer-exclusion fencing has been shown to promote floristic diversity (Urbanek et al. 2012) and permit plant species that are subject to frequent browsing to retain vigor and reproduce (Ruhren and Handel 2003). Even if only a portion of the population can be protected it might allow the rare sedge to persist at the site. Regular monitoring of New Jersey's *C. plantaginea* occurrence is also recommended so that the establishment of invasive plants or other emerging threats can be identified and addressed in a timely fashion.

Although *Carex plantaginea* is currently considered secure throughout much of its range, suitable habitat may be reduced as a result of changing climactic conditions. It would be helpful to have a more solid understanding of some aspects of the species' life history. While the sedge is reportedly easy to propagate intentionally by seed or vegetative growth (Leopold 2005), there seem to be gaps in knowledge about its ability to establish under natural conditions. Potential topics for future *C. plantaginea* research include means of long-distance dispersal, reasons for low seed germination rates, and length of time propagules can persist in the soil.

## **Synonyms**

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

### **Botanical Synonyms**

*Anithista latifolia* (Moench) Raf.  
*Carex latifolia* Moench  
*Deweya plantaginea* (Lam.) Raf.

### **Common Names**

Plantain-leaf Sedge  
Seersucker Sedge  
Carex Plantain

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