

Conservation Assessment
for
Long-stalked Starwort (Stellaria longipes) Goldie



USDA Forest Service, Eastern Region
March 2002



This document is undergoing peer review, comments welcome

This Conservation Assessment was prepared to compile the published and unpublished information on the subject taxon or community; or this document was prepared by another organization and provides information to serve as a Conservation Assessment for the Eastern Region of the Forest Service. It does not represent a management decision by the U.S. Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject taxon, please contact the Eastern Region of the Forest Service - Threatened and Endangered Species Program at 310 Wisconsin Avenue, Suite 580 Milwaukee, Wisconsin 53203.

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EXECUTIVE SUMMARY

Stellaria longipes is part of a highly polymorphic species complex with as many as nine taxa (variously treated as species or varieties) recognized within the complex. Most of the taxa occur in the far North and are circumboreal in distribution. Only the typical *S. longipes* ranges southward into the northern Great Lakes states of Minnesota, Wisconsin, Michigan, and New York where it has ranks of S2 (very rare) and S3 (rare) (NatureServe W-5). The *Stellaria longipes* complex has a global rank of G5 since it is a fairly common alpine meadow plant in the western United States and is found throughout Canada and Alaska. In the Great Lakes area, *S. longipes* occurs most frequently on sandy lakeshores and riverbanks (Coffin & Pfannmuller 1988). *S. longipes* is listed as a Region 9 Sensitive Species on the Hiawatha National Forest. In the Great Lakes Region it occurs within sensitive community types such as dunes or prairie. These natural areas are frequently impacted by human uses such as farming, recreation, and development.

Farther north, “*Stellaria longipes* is actually part of a highly polymorphic species complex” (Coffin & Pfannmuller 1988). However, in the Great Lakes states only the typical *Stellaria longipes* Goldie is found. Its numbers appear to be impaired (S2S3) in the Great Lakes Region. Within this region, *S. longipes* tends to grow in transitional habitats such as stream edges and lakeshores. Riparian and lakeshore habitat is influenced heavily by human impact through lakeshore development, recreational use, and channelization of streams to facilitate agriculture (Coffin & Pfannmuller 1988). In Michigan, *S. longipes* habitat is even more narrowly restricted as it is found in dune habitats, primarily along Lake Michigan and Lake Superior in the Upper Peninsula of Michigan. Even in the western United States and Canada this species continues to be poorly understood.

INTRODUCTION/OBJECTIVES

The National Forest Management Act and U.S. Forest Service policy require that Forest Service lands be managed to maintain viable populations of all native plant and animal species. A viable population is one that has the estimated numbers and distribution of reproductive individuals to ensure the continued existence of the species throughout its range within a given planning area. In addition to those species listed as Endangered or Threatened under the Endangered Species Act, or Species of Concern listed by the U.S. Fish and Wildlife Service, the Forest Service lists species that are sensitive within each region (Regional Forester Sensitive Species).

Stellaria longipes Goldie is on the Regional Forester Sensitive Species List for the Eastern Region of the U.S. National Forest. *Stellaria longipes* is documented to occur on the Hiawatha National Forest. The objectives of management for such species are to ensure their continued viability throughout their range on National Forest lands, and to ensure that they do not become threatened or endangered because of Forest Service actions (FSM 2670.22).

The objectives of this document are to:

1. Provide an overview of current scientific knowledge for this species.
2. Provide a summary of the distribution and status of this species, both rangewide and within the Eastern Region of the USDA Forest Service.
3. Provide the available background information needed to prepare a subsequent conservation strategy.

NOMENCLATURE AND TAXONOMY

Scientific name:	<i>Stellaria longipes</i> Goldie
Common name:	long-stalked starwort; long-stalked stitchwort
Family:	Caryophyllaceae
Plant code:	STLO2 (USDA plant database, W-8)
Synonyms:	(Kartesz 1994, USDA plant database, W-8) <i>Alsine longipes</i> (Goldie) Coville

Alsine palmeri Rydb.
 Alsine stricta (Richards.) Rydb.
 Alsine validus Goodding
 Stellaria dulcis Gervais
 Stellaria edwardsii R.Br.
 Stellaria edwardsii R.Br. var. artica (Schischkin) Hultén
 Stellaria hultenii Boivin
 Stellaria laeta Richards
 Stellaria laeta Richards. var. altocaulis (Hultén) Boivin
 Stellaria laxmannii Fisch.
 Stellaria longifolia Muhl. ex Willd. var. laeta (Richards.) S. Wats.
 Stellaria longipes Goldie ssp. monantha (Hultén) W.A Weber
 Stellaria longipes Goldie ssp. stricta (Richards.) W.A. Weber
 Stellaria longipes Goldie var. altocaulis (Hultén) C.L. Hitchc.
 Stellaria longipes Goldie var. edwardsii (R. Br.) Gray
 Stellaria longipes Goldie var. laeta (Richards.) S. Wats.
 Stellaria longipes Goldie var. monantha (Hultén) Welsh
 Stellaria longipes Goldie var. subvestita (Greene) Polunin
 Stellaria monantha Hultén
 Stellaria monantha Hultén ssp. atlantica Hultén
 Stellaria monantha Hultén var. altocaulis Hultén
 Stellaria monantha Hultén var. atlantica (Hultén) Boivin
 Stellaria palmeri (Rydb.) Tidestrom
 Stellaria stricta Richards
 Stellaria subvestita Greene
 Stellaria valida (Goodding) Coult. & A. Neis.
 Stellaria longipes var. arenicola (Raup) Boivin

DESCRIPTION OF SPECIES

Stellaria longipes is a small rhizomatous perennial, erect to decumbent, loosely tufted, forming small to large clumps or mats (Gleason & Cronquist 1991). *S. longipes* is distinguished by stiff, shiny, erect, pointed, narrow leaves with a prominent midrib. Flowers are a few in a cyme or terminal and solitary; with white petals as long or longer than sepals, deeply cleft nearly to the base appearing as 10 petals (Pojar & MacKinnon 1994). Material for section is compiled from Moss 1983, Weber 1967, Welsh 1974, and Chadde 1998, W-8.

Rootstocks:	Extensive, branched
Stems:	Tufted, erect, or ascending; glabrous, slender, obtusely angled
Leaves:	Glabrous, often shiny or waxy, sessile, strongly keeled, rigid Opposite, linear-lanceolate, 1-4 cm long ascending, without teeth
Flower:	Few to several in scarious-bracteate cyme, slender erect pedicels, Ovary superior, stamens=10, flowers May-August
Bracts:	Small scarious, or broadly scarious margined
Sepals:	Green, ovate-lanceolate, 3-5 mm long, weakly 3-nerved
Pedicels:	Commonly strictly erect, up to 1 ½ inches long

Petals:	White, slightly longer than sepals, cleft nearly to base
Capsule:	Narrowly ovoid; dark brown to purplish black
Seeds:	Lightly reticulate, 0.6 - 0.9 mm long, brown to red-brown

Stellaria longipes is a circumboreal species complex that shows extensive developmental and environmental plasticity. Leaf shape, inflorescence development, and stature are particularly plastic. MacDonald, Chinnappa, and Reid (1984) showed some degree of association of these characters on a north to south gradient, suggesting a phenotypic response to environment or climate. The habit of the complex ranges from a dwarf (3-4 cm) form with a single flower and ovate leaves to a tall (25-30 cm) erect form with branched cymes and lanceolate leaves (MacDonald et al. 1984).

IDENTIFICATION NOTES

Stellaria longipes is part of a highly polymorphic species complex, especially in the northern portion of its range. In *Flora of Ontario* (Morton & Venn 1990) the following species were listed as belonging to this complex and found within the province of Ontario: *S. crassipes*, *S. edwardsii*, *S. laeta*, *S. laxmannii*, *S. monantha*, *S. stricta*, *S. subvestita*. Voss (1985) emphasizes that, in Michigan, *S. longipes* appears to be “a distinctive plant” rather than a large complex of plants.

Distinguishing characteristics developed from Gleason, *Plants for Michigan* (Rabeler 1998), Voss (1985), and *Aquatic Plants of the Northern Great Plains* (W-1).

<i>Stellaria media</i>	- Leaves with broadly ovate blades; with distinct petioles; Eurasian weed - Leaves linear to lanceolate, without petioles
<i>Stellaria crassifolia</i>	Lvs completely glabrous; petals exceed sepals
<i>Stellaria calycantha</i>	- Lvs sparsely ciliate; petals absent or (rarely) nearly equaling sepals
<i>Stellaria longifolia</i>	-Pedicels and lvs spreading; inflorescence open, few to many-flowered - Lvs distinctly linear and long; grows open damp areas, margins of leaves and stems papillose
<i>Stellaria graminea</i>	- Lvs distinctly broadest near base; grassy places, dry sites
<i>Stellaria longipes</i>	-Pedicels erect, lvs narrowly triangular erect on stem, inflorescence narrow, few-flowered, plants short 3-20(25) cm tall

In other regions, *S. longifolia* and *S. longipes* occur in habitats that tend to grade into each other so they must be distinguished by botanical characteristics. In Michigan, the two species occur in distinct habitats. *Stellaria longipes* occurs “very locally in the upper sandy beaches along Lake Superior and at the north end of Lake Michigan.” In contrast, *S. longifolia* occurs in wet habitats such as swamps, marshes, edges of ponds, and bogs (Voss 1985).

DISTRIBUTION AND ABUNDANCE

Stellaria longipes is a circumboreal species found throughout the Americas. This species is more common in Canada, Newfoundland to British Columbia north to the Yukon and Alaska. *S. longipes* is found in the western United States and Nova Scotia where it is an alpine meadow element (Gleason & Cronquist 1991).

“Siberian plants belonging to the same complex are reported as *Stellaria peduncularia*, *S. dahurica*, *S. artica*, and *S. fischeriana* and are closely related to North American species” (Hulten 1968).

State occurrences: Alaska, Arizona, California, Colorado, Idaho, Michigan, Minnesota, western Montana (W-9), Nevada, New Mexico, New York, Oregon, eastern Tennessee (Tenn. Atlas, W-2), North Dakota, Oregon, South Dakota, Utah, Washington, Wisconsin, Wyoming (NatureServe, W-5).

In the western United States, *Stellaria longipes* is a mid-elevation element: New Mexico (7000-12500 ft) (Mann & Hutchins 1968), California (4300-8500 ft) (Jepson 1963), Utah (4200-11000 ft) (W-4). When found at lower elevation, *Stellaria longipes* is commonly found in a riparian habitat (W-6). While there is no indication that this species is threatened in the western United States, more field research is necessary as most western states have a state rank of SR, indicating that not enough is known to make a judgement. However, in Wyoming *S. longipes* has an S4S5 rank indicating it is fairly common (NatureServe, W-5).

Stellaria longipes is most threatened in the Great Lakes Region where it is listed as S2 (very rare) in Michigan and New York, and S3 (rare) in Minnesota (NatureServe, W-5). In Michigan, *S. longipes* is of Special Concern since it only occurs in eastern Upper Peninsula counties: Alger, Schoolcraft, Luce, and Mackinac (Voss 1985). Recently, *S. longipes* was additionally reported from Chippewa County in the Upper Peninsula and Charlevoix County in the Lower Peninsula (MNFI 1999a). In Minnesota, there are only 5 distinct collection sites in three northwest counties; furthermore, there have been no records since 1960 (Coffin & Pfannmuller 1988). In the 1990s, a few more sites were found; there are 13 specimens of *Stellaria longipes* at the University of Minnesota Herbarium (W-7), mostly from Kittson County. In Wisconsin, this species occurs in north-central Wisconsin in Oneida County (Fassett 1976). In New York, this species is found in three counties and is considered rare for the state (Young 1998).

In Canada, the status of *Stellaria longipes* is considered more secure, but much of the northernmost sections of Canada are under explored so its status is simply listed as reported without trying to assess its numbers (NatureServe, W-5). Also, the far northern regions have numerous sub-species to distinguish among (Welsh 1974, Morton & Venn 1990) while in much of the United States only the typical type is known. New Brunswick is the only Canadian Province that lists a critical status of S1 (extremely rare) (NatureServe, W-5). Hinds (1986) elaborated further, “only known from a few sites on Bay de Chaleur, Gloucester and Restigouche Counties”.

HABITAT AND ECOLOGY

Typically, *Stellaria longipes* is found on stony slopes of mountains and in the tundra in the far north. This species is a natural element of alpine meadows throughout much of Canada. It occurs along the north shore of Lake Superior from Grand Portage, Minnesota to Thunder Bay, Ontario east to Marathon, Ontario and Pukaskwa National Park. In New Brunswick, the habitat is sand plains and gravelly banks near the coast (Hinds 1986). *Stellaria longipes* inhabits mixed hardwood/coniferous forests, open woodland, sand beaches or dunes, cliffs, and talus slopes (Soper et al. 1989).

To give a descriptive picture, the following section is excerpted from "The Cruise of the Corwin" by John Muir (W-3). "The region of St. Michael, Alaska is magnificent tundra, crowded with knee-deep cushions of Arctic lichens and mosses. The moss mantle rests on a stratum of ice that never melts, and the ice on a bed-rock of black vesicular lava. Ridges of lava rise here and there above the general level in rough masses, affording ground for plants that like drier soil. There is a sparse growth of grasses, *Carex*, rushes tall enough to wave in the wind along with black crowberry, the dwarf birch, and various heathworts". Some typical associates of *S. longipes* in this habitat include *Polygonum alpinum*, *Draba alpina*, *Saxifraga nivalis*, *Rubus chamaemorus*, *Dryas octopetala*, *Vaccinium vitis-idaea*, and *Primula borealis*" (W-3).

In the western United States, *Stellaria longipes* is a mid-elevation element: New Mexico (7000-12500 ft) (Mann & Hutchins 1986), California (4300-8500 ft) (Jepson 1963), Utah (4200-11000 ft) (W-4). When found at lower elevation, *Stellaria longipes* is common in riparian habitats (W-6). Gleason & Cronquist (1991) lists streams, gravelly or sandy areas for this circumboreal species. University of California at Davis lists *S. longipes* as one of 650 species that favors riparian habitats (W-6). *Stellaria longipes* can be found in wet meadows, stream banks and seepage in the mountains of New Mexico and Arizona (Mann & Hutchins 1986). In the Great Plains states, "moist thickets, stream banks, and meadows" are typical habitat (Barkley 1986).

In Michigan, *Stellaria longipes* is quite limited in habitat occurring mostly along the shores of Lake Superior and northern Lake Michigan near the Straits (Voss 1985); it is a rare plant associate of the wooded dune and swale complex (MNFI 1999b). Many of these complexes began forming when the Great Lakes were at glacial Lake Algonquin levels, approximately 12,000 years ago (Dorr and Eschman 1970). Over several thousand years, a series of ridges and swales is created. For most dune and swale complexes, the flow of surface streams and groundwater maintain the wet conditions in the swales. However, along the Lake Superior shoreline, where post-glacial uplift is greatest, many of the complexes consist primarily of dry, forested swales (Comer and Albert 1993).

In Michigan, *S. longipes* is best known from the Grand Sable Dunes in the Pictured Rocks National Lakeshore (Chadde 1996). This species is documented at Pointe Aux Chenes candidate Research Natural Area in the Hiawatha National Forest in dunes at woods edge (MNFI 1999a). Habitat information was not given for the Wisconsin Oneida County site (Fassett 1976). "In Minnesota, it occurs most often on sandy lakeshores and riverbanks in the prairie region" (Coffin & Pfanmuller 1988).

PROTECTION STATUS

Currently, the official Conservation status for *Stellaria longipes* Goldie, with respect to federal, state, and private agencies is:

Michigan, Minnesota Special Concern Wisconsin (Not tracked)

Natural Conservancy Global rank: G5

U.S. National Rank: N? (Not assessed)

Canadian National Rank: N? (Not assessed)

Region 9 USDA Forest Service: Sensitive on the Hiawatha National Forest

State Rank: (NatureServe, W-5)

Alaska	SR	New Mexico	SR
Arizona	SR	New York	S2
California	SR	North Dakota	SR
Colorado	SR	Oregon	SR
Idaho	SR	South Dakota	SR
Michigan	S2	Utah	SR
Minnesota	S3	Washington	SR
Montana	SR	Wisconsin	SR
Nevada	SR	Wyoming	S4S5

Canadian Provinces: (NatureServe, W-5)

Alberta	S5	Nova Scotia	SR
British Columbia	S?	Nunavut	SR
Labrador	SR	Ontario	S5
Manitoba	S5	Quebec	SR
New Brunswick	S1	Saskatchewan	S?
Newfoundland	SR	Yukon Territory	SR
Northwest Territories	SR		

Definition of State and Provincial Ranks: (Young 1998)

S1 = Extremely rare; typically 5 or fewer known occurrences in the state; or only a few remaining individuals; may be especially vulnerable to extirpation.

S2 = Very rare; typically 5 between 6 and 20 known occurrences; may be susceptible to becoming extirpated.

S3 = Rare to uncommon; typically 21 to 50 known occurrences; S3 ranked species are not yet susceptible to becoming extirpated in the state, but may be if additional populations are put at risk.

S4 = Common, apparently secure under present conditions; typically 51 or more known occurrences, but may be fewer with many large populations; usually not susceptible to immediate threats.

S5 = Very common; demonstrably secure under present conditions.

SR = Reported from the state, but without persuasive documentation that would provide a basis for either accepting or rejecting the species.

S? = Not enough information available to assess at this time, more field studies and/or specimen identification is needed.

LIFE HISTORY

Stellaria longipes is a perennial herbaceous plant that reproduces by seed formed within a capsule. “Floral structure is unspecialized. The petals and sepals open to produce a flat, saucer-shaped flower with the superior ovary exposed in the center surrounded by 10 stamens. Small nectaries are present at the base of the stamens and secrete minute amounts of nectar” (Chinnappa & Morton 1984). Ordinarily the capsule is dehiscent with 3(4) styles (Gleason & Cronquist 1991). Reproductive output was measured at 20 seeds/ramet for *S. longipes* (MacDonald et al. 1987). Sexual reproductive efficiency in one controlled study (MacDonald et al. 1987) was 50 – 55% of the ovules becoming seeds.

The flowers are normally protandrous. “The filaments, which are erect at the time the anthers dehisce, bend towards the corolla and away from the expanding stigmas, thus reducing the opportunities for self-pollination” (Chinnappa & Morton 1984). Breeding systems studies (MacDonald et al. 1987) showed approximately 44% gynoeious individuals, 38 % hermaphrodites, and 18% gynomonoeicy.

In a sand dune environment, the primary pollinators of *Stellaria* species were *Bombus melanopygus* and *B. terricola*. Observations of foraging behavior indicated that the bees generally visited several flowers in a clone before moving on to another nearby genet (MacDonald et al. 1987). “Many nonspecific insects flew indiscriminately between various white-flowered members of Caryophyllaceae that were in flower, including other species of *Stellaria*, *Arenaria*, and *Cerastium*” (Chinnappa & Morton 1984).

“*Stellaria longipes* is a herbaceous perennial which can reproduce vegetatively by rhizomes. A single clone (genet) consists of a number of single or branching above ground stems (ramets) which arise from the internodes of rhizomes” (MacDonald & Chinnappa 1989).

Wild populations of *S. longipes* differ greatly in respect to phenotypically plastic characters such as leaf shape, habit, and inflorescence. When samples from these populations are grown under uniform conditions the differences usually persist either in full or to a reduced extent. This suggests that there are many different genotypes, each responding differently to the influences of the environment and producing a different phenotype that is itself plastic and subject to changes both during development and under different environments.

“In *Stellaria longipes*, there is no evidence as yet of a relationship between amount of plasticity and genetic variability. Despite differences in the amount of plasticity, all five studied populations were shown to have equal and extensive isozyme variability. Isozyme analysis showed genetic divergence corresponding to geographical distance which could suggest random genetic drift” (MacDonald & Chinnappa 1989). It was concluded that trait means, amounts of plasticity, and patterns of plasticity are independent of one another during evolutionary divergence. “Overall, differences among populations in pattern of plasticity were much more common than differences in amount of plasticity”

(MacDonald & Chinnappa 1989). A later molecular-cloning experiment found “no significant polymorphism among different genotypes” (Zhang & Chinnappa 1994b). “However, different genotypes showed variations in the total triose phosphate isomerase (TPI), possibly reflecting the ecological effect” (Zhang & Chinnappa 1994b).

POPULATION VIABILITY AND PROTECTION

In Michigan, the largest population is protected within Pictured Rocks National Lakeshore. However, increasing visitation results in more dune climbers at Grand Sable Dunes within the park, causing more blowout areas on the dunes which could impact the viability of this population. This species is found at Pointe Aux Chenes along Lake Michigan on the Hiawatha National Forest. This element occurrence extends along several sections; this site has been given a C ranking by MNFI (2001) indicating somewhat poor long-term viability, and average short term viability. This population might become shaded out by forest succession. Characteristically, *Stellaria longipes* is a more northern species or is found in mountainous regions such as the Smokies or the Rocky Mountains. *S. longipes* is limited in Michigan, probably because it is at its southern range extent in the Great Lakes States.

Throughout the major portion of its range, *Stellaria longipes* is a very successful species showing wide distribution in a diversity of habitats. Phenotypic plasticity can contribute significantly to the success of a species by providing a means for adaptation of the individual to changing environmental conditions (MacDonald et al. 1984). “*Stellaria longipes* is particularly successful in exploiting open (disturbed) conditions because of its reproductive biology, its phenotypic plasticity, and its large heterogeneous gene pool produced by polyploidy and outbreeding” (Chinnappa & Morton 1984).

“Polyploidy has played a role in the success of the *Stellaria longipes* complex. The wide range of polyploides (from $2n = 51$ to 107), their interfertility, and the high level of fertility in the progeny are unusual. These features permit the formation of a greater range of new genomes than outbreeding alone could produce. Also polyploidy, by duplicating whole genotypes and gene associations on individual chromosomes, greatly increases the gene pool. In *S. longipes* the large gene pool and the high level of heterozygosity help to protect most populations from adverse conditions” (Chinnappa & Morton 1984).

POTENTIAL THREATS

In Minnesota and other prairie states many lakes have been considerably altered or drained to make room for cornfields. Also, streams have frequently been channelized to carry runoff waters to facilitate farming thus eliminating suitable streamside habitat (Coffin & Pfannmuller 1988).

In Michigan, *S. longipes* is confined to dune habitat along the shores of Lake Superior and Lake Michigan (Voss 1985). Dune habitat is appealing for recreational use, secondary vacation homes, and the invasion of noxious non-native weeds. Spotted knapweed (*Centaurea maculosa*) is marching forward from the back dunes to the foredunes along informal trails at Grand Sable Dunes in the Pictured Rocks National Lakeshore, and could effect populations of *S. longipes* in the future (B. Leutscher, pers. comm. 2001). Spotted knapweed is also a threat at Point Aux Chenes (Jan Schultz, pers. comm. 2001).

REASONS FOR ONGOING CONCERN/MANAGEMENT

In the Great Lakes states of Minnesota, Wisconsin, Michigan, and in New York *Stellaria longipes* has a state rank of S2 or S3 (imperiled or vulnerable). In Michigan, it is listed as Special Concern. It appears to be more local and rare than many plants listed as Threatened; and therefore, more field studies are necessary to determine its distribution. In Michigan, *S. longipes* is mostly confined to the eastern Upper Peninsula. It has recently been reported growing in Charlevoix County in the northern lower peninsula (MNFI 1999a).

In the western United States and much of Canada, *Stellaria longipes* has a state rank of SR indicating that more field studies are necessary to assess whether this species is impaired.

Numbers of this species may be underestimated since “botanists often fail to collect in transitional habitats and thus frequently overlook lakeshore habitats” (Coffin & Pfannmuller 1988). Reliance on pre-assigned GPS plots tends to favor broader community type sampling and overlook riparian habitats that botanists exploring on their own are likely to survey.

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Web Sites

- W-1. Aquatic and Wetland Vascular Plants of the Northern Great Plains
<http://www.npwrc.usgs.gov/resource/1999/vascplnt/genstell.html>
- W-2. Atlas of Tennessee Vascular Plants
<http://www.bio.utk.edu/botany/herbarium/vascular/atlas/dicots.../stellaria-longifolia.htm>
- W-3. Cruise of the Corwin
http://www.sierraclub.org/john_mui...uise_of_the_corwin/appendix_2.html
- W-4. Digital Atlas of the Vascular Plants of Utah
<http://www.gis.usu.edu/Geography-D...og/utvatlas/family/cary/stlo2.html>
- W-5. NatureServe
http://www.natureserve.org/servlet/NatureServe?sourceTemplate=species_RptComprehensive.wmt&load
- W-6. Riparian Species
http://endeavor.des.ucdavis.edu/newcara/riparian3.asp?cara_id=52

W-7. University of Minnesota Herbarium

<http://wildflowers.umn.edu/public/results.asp?search=countychk&id=1007>

W-8. USDA Plant Database

http://plants.usda.gov/plants/cgi_bin/plant_profile.cgi?symbol=STLO2

W-9. Western Wetland Flora. Northern Prairie Wildlife Research Center.

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W-10. Wisconsin Vascular Plants: Herbarium

<http://wiscinfo.doit.wisc.edu/herbarium/scripts/detail.asp?SpCode=STELONI>

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