

# *Carex* of Three Sisters Springs

Linda Curtis 2012



*A haven for large manatees and small herbaceous plants, Three Sister Springs has fringes of original vegetation including genus *Carex* of family Cyperaceae. The grass-like tufts are part of the ground herb layer that supports the terrestrial food chain. Linda Curtis, author-botanist, searched the native vegetation around the springs pool, channel, and roadside wet depressions and discovered five species, with a potential for many more.*

*Specimens were sent to University of Florida herbaria and their photos placed online at (<http://florida.plantatlas.usf.edu/>).*

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Abstract: Three Sisters Springs is the only one of 30 known springs in Kings Bay/Crystal River system that can be reached by land instead of boat. Five species of *Carex* were found growing around the springs, the surrounding former pasture, and the forested roadside ditches. Since 2010 the area has been open to the public only a few days a year, allowing the safety of the over-wintering manatees in the springs. A boardwalk now directs visitors around part of the springs and spares the sedges and wildflower association of plants from trampling. Five *Carex* species found in March and April 2012 were: *C. gholsonii* Naczi & Cochrane, *C. godfreyi* Naczi, *C. leptalea* Wahlenb., *C. longii* Mack and *C. styloflexa* Buckley. A potential for 35 species of *Carex* is based on research, inventories and herbarium vouchers.

## INTRODUCTION

Location and geology: The vegetation of Three Sisters Springs in Crystal River, King's Bay, Citrus County Florida is that of gulf forest, with the water table a few feet below the thin peaty soil over limestone substrate. The spring waters moderate around 72 degrees and travel six miles west to the salt marshes along the Gulf of Mexico.

The habitats in the Three Sisters Spring include a narrow strip of hydric forest around the spring pool perimeter and in wet ditches along the roadside. The largest habitat is ruderal with agricultural disturbance and pasturing, meaning most of the natural vegetation of Three Springs was removed. An aerial photograph reveals uniform tillage row marks. Arrows point to places where *Carex* species were collected (Fig. 1).

Ferns, trees and shrubs surround the blue water springs. Tree species include red maple, *Acer rubrum*, water oak, *Quercus nigra*, cabbage palm, *Sabal palmetto*, sweetgum *Liquidambar styraciflua* plus bald cypress *Taxodium distichum*. Native tree saplings were planted along the boardwalk in 2012 as part of a restoration project. *Carex* grow in the herb layer with grasses (Poaceae), other sedges (Cyperaceae) and rushes (Juncaceae).

A permit to collect only *Carex* culms was requested on 3-14-2012 from the United States Department of the Interior US Fish and Wildlife Service National Wildlife Refuge System General Special Use Application and Permit, was granted 3-22-12 until expiration 06-30-2014 with contact by Joyce M. Kleen, Refuge Official. Culms were to be sent to UFL herbaria.

Crystal River/King's Bay is south of the Withlacoochee River that is the southernmost border of the Big Bend region that extends into the Florida Panhandle. The Crystal River/King's Bay area has coastal hydric forest adjoining the salt marsh coastland to the east, including several islands.

The NFWS did not have a species inventory specific for Three Sisters Spring but used the 1982-1983 plant inventory from the similar coastal Chassahowitzka National Wildlife Refuge to the south. Only one species was listed, *C. leptalea* (Marscus 1983). However, other species were found along the Chassahowitzka River in 1991. One was *C. chapmanni* and two new sedges later named *C. gholsonii* (Naczi, Bryson, & Cochrane, 2002) and *C. godfrey* (Naczi 1993). All three grow in the five Gulf Coast counties.

A more complete inventory was found from the Waccasassa Bay State Preserve in the southernmost part of the Big Bend and included eight species of *Carex* (Abbot and Judd 2002). The list covered five natural communities: tidal marsh, coastal hydric hammock, freshwater pools, basin swamp and mesic to scrubby flatwoods. The hydric hammocks were seen as a mix of smaller communities and the research concluded it was one highly variable community by quantitative analysis of associations. *Carex* grew mostly in coastal hydric hammocks, clearings, and basin swamps (Table 1).

This author's recent *Carex* research in 2008-09 added ten species to the Crystal River Preserve State Parks Inventory, compiled by Keith Morin, Park Biologist (Table 3). The research permit #002250812 was granted by Florida Dept. of Environmental Protection and issued on 2-25-08 for the Crystal River Parks of Dixie Shores, Yoeman, Ecowalk, Churchhouse Hammock and the Archaeological State Park. Renewals were granted on Jan 27, 2009 and again on May 4, 2010 for collecting *Carex* at Fort Cooper, Homosassa Springs, Manatee, Fanning, Yulee Sugar Mill Ruins, Crystal River Preserves, Crystal River Archaeological and Cedar Key Preserve State Parks. Species collected were compiled with UFL herbaria data (Tables 4).

## METHODS

The earliest research entry was through a locked gated on 3-26-2012 at global position N28 53.520 W82 35.469. *Carex* were photographed with a macro-lens camera to record *Carex* growth habit, rhizomatous vs cespitose, and to photograph nearby associates. To mark global position, a second digital camera was used, a Canon EOS5D Mark II with a GPS Data Logger with a Wireless File Transmitter motorized base and 2 Wintec G-Rays GPS unit mounted on the camera hot shoe. Photos were printed with imbedded GPS information.

Fieldwork in late March and April in 2012 at Three Sisters Springs required slow walking and gazing and much bending and stooping. *Carex* species are grass-like in appearance and difficult to identify in the field by leaves alone. Leafy tufts and clumps were hand-combed to find triangular culms with tubular sheaths and seed heads with sac-like perigynia.

Culms were kept fresh in beakers of rainwater for several days while they were scanned, micro-imaged and identified using the keys in *Guide to the Vascular plants of Florida* Wunderlin and Hansen, 2011 and *Flora of North America* 2002, Volume 23: *Cyperaceae*. The digital images were sent to the *Atlas of Florida Vascular Plants*, a website of photos and county locations of species (<http://florida.plantatlas.usf.edu/>).

Five species were identified, (Table 1) but one species was problematic as only culms could be taken and rhizome length less than 5 cm distinguishes it from state threatened *C. chapmannii*. The UFL-Tallahassee herbarium has a *C. styloflexa* specimen from a “border of a spring 2 miles west Crystal River” dated March 23, 1941. A check of that specimen’s longest rhizome was 3.5 cm, and verified as *C. styloflexa*, so the Three Sisters Springs plant may be that species also, not *C. chapmannii*.

Map work included studying the Google Earth™ images and maps from the NFWS office. An aerial view shows two water bodies, the larger a lake formed after limestone removal, and the smaller a spring pool with a tree lined inlet channel (Figure 1). Some *Carex* species grew in the ground layer among the narrow fringe of trees around the channel and pool but none were yet found around the artificial lake. Other *Carex* grew in the clearings, wooded borders, and the roadside wet depressions along Kings Bay Drive.

Figure 1. The Carex locations of 2012 research at Three Sisters Spring



Other inventories were compiled and compared to Three Sisters Springs.

**TABLE 1. Carex of Waccasassa Bay State Preserve, Levy Co. (Abbot & Judd 2002)**

| Species   | Common name            | Habitat  |
|---|------------------------|--|
| <i>C. blanda</i> Dewey                                  | Eastern Woodland Sedge | Mesic-wet hardwood forests                       |
| <i>C. chapmannii</i> Steud.                             | Chapman's Sedge        | Hydric forests                                   |
| <i>C. cherokeensis</i> Schwein.                         | Cherokee Sedge         | Wet calcareous forests                           |
| <i>C. fissa</i> Mack. var.<br><i>aristata</i> F.J. Herm | Hammock Sedge          | Hydric hammocks, clearings,<br>ditches           |
| <i>C. godfreyi</i> Naczi                                | Godfrey's Sedge        | Wet to mesic, usually<br>calcareous hammocks     |
| <i>C. hyalinolepsis</i> Steud.                          | Shoreline Sedge        | Marsh and coastal swales                         |
| <i>C. lupuliformis</i> Sartwell<br>ex Dewey             | False Hop Sedge        | Cypress swamps, river<br>shores, hydric hammocks |
| <i>C. vexans</i> R. J. Herm                             | Florida Hammock Sedge  | Marshes ditches, roadsides                       |

**TABLE 2. *Carex* of Crystal River Preserve & Parks, 2008-09 Linda Curtis, collector**

| Species                                       | Common name               | Habitat  |
|---|---------------------------|--|
| <i>C. chapmanii</i> Steud                     | Chapman's Sedge           | Calcareous hydric hammocks                         |
| <i>C. dasycarpa</i> Muhl                      | Sandywoods Sedge          | Dry mesic, sandy upland                            |
| <i>C. floridana</i> (Schweinitz)<br>Kukenthal | Florida Sedge             | Dry mesic, sandy upland                            |
| <i>C. gholsonii</i> Naczi &<br>Cochrane       | Gholson's Meadow<br>Sedge | Mesic to wet clearings aside<br>forests, roadsides |
| <i>C. godfreyi</i> Naczi                      | Godfrey's Sedge           | Calcareous hydric hammocks                         |
| <i>C. leptalea</i> Wahlenb.                   | Bristly Stalked Sedge     | Swamps, wet hammocks                               |
| <i>C. longii</i> Mack.                        | Long's Sedge              | Marsh and coastal swales                           |
| <i>C. lupuliformis</i> Sartwell ex<br>Dewey   | False Hop Sedge           | Cypress swamps, river shores,<br>hydric hammocks,  |
| <i>C. stipata</i> Muhl. Ex Willd.             | Awlfruit Sedge            | Marshes, wet clearings                             |
| <i>C. vexans</i> R. J. Herm                   | Florida Hammock<br>Sedge  | Hydric hammocks, marshes<br>ditches, roadsides     |

FNA (2002) recognizes *Carex floridana* Schweinitz, but not recognized by Wunderlin and Hansen's *Guide to Vascular Plants of Florida* 2011 that has *C. nigromarginata* Schwein var. *floridana* Kukenthal.

Other previous *Carex* fieldwork by the author was at Homosassa Springs State Park, Goethe State Forest, and Devil's Hammock Wildlife Management Area. In 2009, Homosassa Springs Wildlife State Park had *C. godfreyi* along Pepper Creek Birding Trail, *C. chapmanii* along the bus parking lot, *C. longii* and *C. gholsonii* along a wooded side trail.

The 2010-12 Goethe State Forest *Carex* collection in Levy County required a state permit. Five species of *Carex* grew along Ten Mile Creek: *C. fissa*, *C. gholsonii*, *C. godfreyi*, *C. longii*, and *C. lupuliformis*.

Devil's Hammock Wildlife Management Area in Levy County required a special permit and site manager approval. Four former logging roads lead into the Waccasassa River. Bearfoot trail had *C. verrucosa*, *C. lupuliformis*, *C. gigantea*, and *C. vexans*. Parker Field Road, Log Pine Road and River Camp Road had *C. fissa*, *C. gholsonii*, *C. godfreyi* and *C. dasycarpa*.

*C. stipata* and *C. lupuliformis* grew along the shores of the Withlacoochee River on both the Citrus and Marion County sides, but also in wet roadside ditches along county roads.

## RESULTS

The 2012 field search at Three Sisters Springs found 5 species (Table 3) of potentially 35 documented from specimens at UFL herbaria (Table 4).

**TABLE 3. *Carex* of Three Sisters Springs 2012 Linda Curtis, Collector**

| Species & date                              | Common name & gpi   | Habitat at Three Sisters                              |
|---|---|---|
| <i>C. gholsonii</i> Naczi & Cochrane 4-5-12 | Gholson's Meadow Sedge<br>N28 53.285 W82 35.5<br>N28 53.233 W82 35.296<br>N28 53.295 W82 35.348 | Mesic to wet clearings.<br>along boardwalk            |
| <i>C. godfreyi</i> Naczi<br>4-10-12         | Godfrey's Sedge<br>N28 53.520 W82 35.469  | Mesic to wet clearings<br>along boardwalk             |
| <i>C. leptalea</i> Wahlenb.<br>4-10-12      | Bristly Stalked Sedge<br>N28 53.508 W82 35.419<br>N28 53.520 W82 35.469                         | Calcareous wet forested ditch<br>along Kings Bay road |
| <i>C. longii</i> Mack.<br>4-5-12 & 4-10-12  | Long's Sedge<br>N28 53.290 W82 35.298<br>N28 53.216 W82 36.00                                   | Along perimeter road and<br>clearing near boardwalk   |
| <i>C. styloflexa</i> Buckley<br>3-26-12     | Bent Sedge<br>N28 53.519 W82 35.517<br>N28 53.520 W82 35.469                                    | Wet forested ditch along<br>Kings Bay Road            |

**Table 4. *Carex* Inventory of Citrus, Dixie, Levy, Marion, and Hernando Counties**

| Carex species  | Common name       | Habitat                          |
|--|-------------------|----------------------------------|
| <i>C. alata</i> Torr.  | Broadwing Sedge   | Marshes, swamps, wet hammocks    |
| <i>C. atlantica</i> subsp. <i>capillacea</i> (L.H.Bailey) Reznicek | Prickly Bog Sedge | Bogs and swamps                  |
| <i>C. basiantha</i> Steud.   | Willdenow's Sedge | Mesic hardwood forest            |
| <i>C. blanda</i> Dewey   | Woodland Sedge    | Mesic and wet forests            |
| <i>C. bromoides</i> Schkuhr ex Willd.                              | Bromelike Sedge   | Dry cypress swamps, wet hammocks |
| <i>C. chapmannii</i> Steud.  | Chapman's Sedge   | Calcareous wet hammocks          |
| <i>C. cherokeensis</i> Schwein.                                    | Cherokee Sedge    | Wet to mesic calcareous forests  |
| <i>C. comosa</i> Boott.  | Longhair Sedge    | Marshes, swamps                  |
| <i>C. complanata</i> Torr. & Hook.                                 | Blue Sedge        | Wet hammocks, clearings          |

|   |                          |  |
|---|--------------------------|--|
| <i>C. crebiflora</i> Wiegand  | Coastal Plain Sedge      | Mesic hammocks   |
| <i>C. crus-corvi</i> Shuttlw. ex Kunze                                | Ravenfoot Sedge          | Swamps, marshes,<br>lakeshores                               |
| <i>C. dasycarpa</i> Muhl.   | Sandywoods Sedge         | Dry-mesic sandy forests                                      |
| <i>C. debilis</i> Michx.  | White-edge Sedge         | Swamps, creek sides  |
| <i>C. digitalis</i> Willd.  | Slender Wood Sedge       | Sandy upland forests   |
| <i>C. elliotii</i> Schwein. & Torr.                                   | Elliott's Sedge          | Bogs and swamps  |
| <i>C. fissa</i> var <i>aristata</i> F. J. Herm.                       | Hammock Sedge            | Clearings, ditches,<br>Mesic-wet clearings, forest<br>edges. |
| <i>C. gholsonii</i> Naczi & Cochrane                                  | Gholson's Sedge          |  |
| <i>C. gigantea</i> Rudge  | Giant Sedge              |  |
| <i>C. godfreyi</i> Naczi  | Godfrey's Sedge          | Mesic-wet hardwood<br>hammocks                               |
| <i>C. hyalinolepis</i> Steud.   | Shoreline Sedge          | Marshes, coastal swales                                      |
| <i>C. intumescens</i> Rudge   | Greater Bladder<br>Sedge | Swamps, wet-mesic<br>clearings                               |
| <i>C. joorii</i> L.H. Bailey  | Cypress Swamp<br>Sedge   | Swamps, floodplains  |
| <i>C. leptalea</i> Wahlenb.   | Bristly Stalked<br>Sedge | Wet ditches, swamps  |
| <i>C. longii</i> Mack.  | Long's Sedge             | Clearings, marshes,<br>hammocks                              |
| <i>C. louisianica</i> L.H. Bailey                                     | Louisiana Sedge          | Swamps, floodplains  |
| <i>C. lupuliformis</i> Sartwell ex Dewey                              | False Hop Sedge          | Swamps, ditches, wet<br>forests                              |
| <i>C. lurida</i> Wahlenb.   | Sallow Sedge             | Bogs, marshes, swamps,                                       |
| <i>C. nigromarginata</i> var <i>floridana</i><br>(Schwein.) Kukenthal | Blackedge Sedge          | Mesic forest openings  |
| <i>C. oxylepsis</i> Torr. & Hook.                                     | <i>Sharpscale Sedge</i>  | Mesic-wet hardwood<br>forests                                |
| <i>C. paeninsulae</i> Naczi et al                                     | Peninsula Sedge          | Mesic forests  |
| <i>C. retroflexa</i> Muhl. Ex Willd.                                  | Reflexed Sedge           | Sandy dry mesic forests                                      |
| <i>C. striata</i> Michx.  | Walters's Sedge          | Marshes, cypress swamps,<br>ditches                          |
| <i>C. stipata</i> Muhl. ex Willd.                                     | Awlfruit Sedge           | Marshes, swamps, clearings                                   |
| <i>C. styloflexa</i> Buckley  | Bent Sedge               | Moist to wet hammocks  |
| <i>C. verrucosa</i> Muhl.   | Warty Sedge              | Bogs, swamps, ponds  |
| <i>C. vexans</i> F. J. Herm.  | Florida Hammock<br>Sedge | Hydric hammocks,<br>marshes ditches, roadsides               |

Inventory compiled from *Carex* collections by Linda W. Curtis plus locations given in Wunderlin & Hansen 2011, and herbaria websites UF-Gainesville, UF-Tallahassee and UF-Tampa's Florida Atlas. *C. floridana* (Naczi) is recognized by FNA 2002, but not Wunderlin and Hansen 2011. *C. basiantha* = *C. willdenowii* misapplied.



## CONCLUSION

Although Three Sisters Springs has lost most of its native vegetation, five *Carex* species grew in the fringe of vegetation around the pool of the springs and its channel, the clearings around the boardwalk and along the wooded wet roadside ditches. Of the 35 species known from adjoining counties from three herbaria and this research, more *Carex* are likely to be found. The *Carex* species at Three Sisters Springs also grow in similar habitats as the adjoining counties. Global positions were included on specimen labels.

## LITERATURE AND WEB SITES

Abbot & Judd. 2002. *Rhodora* vol 102 p 495. An inventory of coastal hydric hammock of Waccasassa Bay State Preserve.

Atlas of Florida Vascular Plants. 2012. Images, specimens of vascular plants, and county locations. (<http://florida.plantatlas.usf.edu/>)

Ball, P.W., and Reznicek A.A., eds. 2002. *Cyperaceae*. Flora of North America, vol. 23: 254-573. New York: Oxford University Press.

Curtis, L.W. 2012. FLAS University of Florida Herbarium, Florida Museum of Natural History [www.flmnh.ufl.edu/herbarium/cat/search.asp?last=Curtis&Family=Cyperaceae&style=r](http://www.flmnh.ufl.edu/herbarium/cat/search.asp?last=Curtis&Family=Cyperaceae&style=r). cat/search.asp?accno=228700, 228701, 228702, 228703, 228704

Curtis, L.W. 2012. University of Florida Herbarium, Tallahassee, Florida [http://herbarium.bio.fsu.edu/search-specimens.php?search=Search&toggle\\_showhide=on&CollectionCodeID=&taxon\\_rank\\_fam=&taxon\\_rank\\_gen=&taxon\\_rank\\_sp=&taxon\\_rank\\_vernam=&cdat\\_crit=%3D&cdat2\\_crit=%3D&cdat2=&RecordCollectorHumanName=+Curtis%2C+Linda+Wilson&RecordCollectorID=LindaCurtis652&cid=&accid=&cou=&stapro=&coupar=&nnp=&fl=&fr=&habitat=&toggle\\_listed=on&fleppc=&state\\_status=&fedstatus=&fedwet=&statewet=&origin=&inFlorida=&inPanhandle=&fnaitrack=&grank=&srank=&sort\\_by=gen%2Csp%2Cisprk%2Cisp&output\\_type=Thumbnails](http://herbarium.bio.fsu.edu/search-specimens.php?search=Search&toggle_showhide=on&CollectionCodeID=&taxon_rank_fam=&taxon_rank_gen=&taxon_rank_sp=&taxon_rank_vernam=&cdat_crit=%3D&cdat2_crit=%3D&cdat2=&RecordCollectorHumanName=+Curtis%2C+Linda+Wilson&RecordCollectorID=LindaCurtis652&cid=&accid=&cou=&stapro=&coupar=&nnp=&fl=&fr=&habitat=&toggle_listed=on&fleppc=&state_status=&fedstatus=&fedwet=&statewet=&origin=&inFlorida=&inPanhandle=&fnaitrack=&grank=&srank=&sort_by=gen%2Csp%2Cisprk%2Cisp&output_type=Thumbnails)

Marcus, Stuart. 1983, Plant Inventory of Chassahowitzka NWR, Kings Bay Road, Crystal River, Florida

Moran, Keith 2012. Plant Inventory of Crystal River Parks and Recreation. Sailboat Drive, Crystal River, Florida

Naczi, R. H. 1993. *Carex brysonii* and *Carex godfreyi*, new species of *Carex* section *Griseae* (Cyperaceae) from the southeastern United States.

Naczi, R. H., Bryson, C. T., Cochrane, T. S., 2002. Seven New Species and One New Combination in *Carex* (Cyperaceae) from North America. *Novon*: 12, No. 4, p 526.