

**Florida At-Risk Species Surveys**  
**Final Performance Report for F20AC11768-01**

**October 1, 2020- September 30, 2022**

Florida Museum of Natural History  
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**January 28, 2023**

**PROJECT LOCATION:** North and Central Florida

**PRIMARY PROJECT OBJECTIVE(S):** The primary objectives for this one year study are to: 1) re-confirm the current areas of occupancy for the Dukes' Skipper, and 2) expand the search for previously undocumented populations for this species in new locations that have suitable habitat.

**BACKGROUND:**

Figure 1 shows the known distribution of this skipper within Florida when the species was originally described (Shuey, 1996).

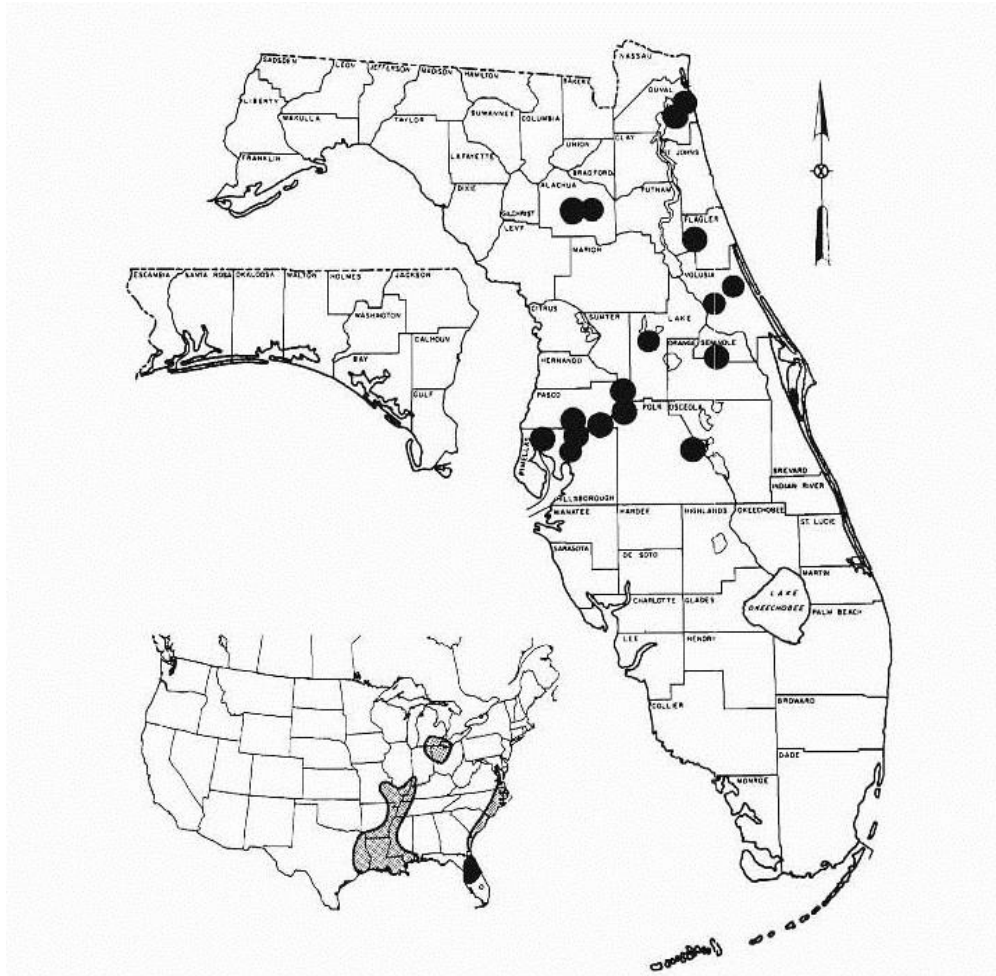


Figure 1. Distribution of *Euphyes dukesi calhouni* in Florida. Adapted from Shuey (1996). Solid dots represent known localities. Shaded map shows the generalized known range of *Euphyes dukesi*.

Since that time, the species has disappeared from many of the original locations (John Calhoun, pers. comm.). The species has not been since in Duval County since 2006 and has not been reported from the inland counties (i.e., Alachua, Lake, and Polk) since the original surveys by John Calhoun.

Initial data compiled by the Florida Natural Area's Inventory (FNAI) from six years of FWC state wildlife grant funding (2007 through 2012) focused specifically on populating its database with current locations of newly tracked at-risk butterfly taxa suggest that the distribution of this only endemic Florida butterfly taxon outside of south Florida, the Dukes' (Calhoun's) Skipper, has declined dramatically during the last 20 years. Much of this range contraction appears to be tied to altered hydrologic regimes (lowered groundwater table levels) in high quality hydric hammock or mixed wetland hardwood, its primary habitats.

Between fall 2015 and spring 2018, University of Florida and community science surveyors documented populations of the Dukes' Skipper in four areas in Florida. These were 1) the Tide Swamp and Jena Units of the Big Bend Wildlife Management Area, 2) the Lower Suwannee National Wildlife Refuge, 3) a contiguous block of several public lands encompassing the Richloam Tract of the Withlacoochee State Forest, the Southwest Florida Water Management District's (SWFWMD) Green Swamp tracts, and Colt Creek State Park, and 4) the Tosohatchee and Seminole Ranch Wildlife Management Areas.

For the earlier Dukes' Skipper surveys mentioned above, geographic information system (GIS) software was used to map the Florida Cooperative Land Cover map (Florida Fish and Wildlife Conservation Commission, 2015) relative to Florida conservation lands to identify high priority areas for Dukes' Skipper surveys. Because larger areas of contiguous suitable habitat are more likely to sustain a Dukes' Skipper population long-term, those earlier surveys concentrated on conservation lands where Dukes' Skippers have historically been documented or contained multi-thousand acres of reasonably contiguous hydric hammock or mixed wetland hardwoods. The 2020-2021 surveys will utilize the same criteria but relax the acreage size requirements for conservation lands that may be in close proximity to currently-extant Dukes' Skipper populations.

Utilizing the above guidelines results in a list of 14 conservation lands identified to be of high-priority survey sites for the 2020 – 2021 Dukes' Skipper surveys. Table 1 contains a list of the 14 sites. Seven of these lands have had Dukes' Skipper populations documented during the earlier 2015 -2018 surveys and seven conservation lands are ones at which Dukes' Skipper have not yet been documented but which have high potential for containing a viable Dukes' Skipper population.

**Table 1: HIGHEST PRIORITY DUKES' SKIPPER SURVEY SITES, 2020 – 2022**

Managed Area Name	Location (county)	Suitable Acreage	Managing Agency	Previously Documented?
Big Bend Wildlife Management Area	Dixie, Taylor	57,287	FL Fish and Wildlife Conservation Commission	Yes
Buck Lake Conservation Area	Brevard	733	St. Johns River Water Management District	No
Charles H. Bronson State Forest	Orange, Seminole	5,531	Florida Forest Service	No
Chassahowitzka National Wildlife Refuge	Citrus, Hernando	31,475	U.S. Fish and Wildlife Service (USFWS)	No
Chassahowitzka Wildlife Management Area	Hernando	15,724	FL FWC	No
Colt Creek State Park	Polk	733	FL Department of Environmental Protection	Yes
Green Swamp	Lake, Pasco, Polk, Sumter	3,270	SW Florida Water Management District	Yes
Lower Suwannee National Wildlife Refuge	Dixie, Levy	35,305	U.S. Fish and Wildlife Service (USFWS)	Yes
Lake Woodruff National Wildlife Refuge	Lake, Volusia	13,506	U.S. Fish and Wildlife Service (USFWS)	No

Ocala National Forest	Lake, Marion, Putnam	26,050	National Forest Service (USFS)	No
Seminole Ranch Conservation Area	Brevard, Orange, Seminole, Volusia	5,315	FL Fish and Wildlife Conservation Commission	Yes
St. Johns National Wildlife Refuge	Brevard	102	U.S. Fish and Wildlife Service (USFWS)	No
Tosohatchee Wildlife Management Area	Orange	5,440	FL Fish and Wildlife Conservation Commission	Yes
Withlacoochee State Forest	Citrus, Hernando, Pasco, Sumter	8,474	Florida Forest Service	Yes

**WORK COMPLETED:** Owing to the two annual flight periods of the butterfly, the results are summarized for 2021 (spring and fall surveys) and 2022 (spring and fall surveys).

Dukes' Skipper Spring 2021 Surveys were conducted by a combination of 1) a field researchers employed by the Florida Museum of Natural History, University of Florida, 2) citizen scientist volunteers who accepted survey locations assigned to them, and 3) other competent field biologists and private citizens who could not commit to any formal survey assignments or survey protocols but whose knowledge and participation would help this project meet its goal and objective of developing a comprehensive and more current picture of the distribution of Dukes' skippers in Florida. Table 2 below provides a summary of conservation land areas surveyed and the date(s) visited. There was a total of 19 conservation land surveyed for Dukes' skippers during spring 2021. Approximately one third of sites have had Dukes' skipper records during the last five to ten years while the remaining properties warrant searches for Dukes' skippers based on habitat suitability. Data collected included general habitat assessment/suitability and adult surveys. Detailed photographs of the sites and specific habitat locations were also taken.

**TABLE 2: SPRING 2021 DUKES' SKIPPER ADULT SURVEY LOCATIONS AND DATES.**

SURVEY LOCATION	ACTUAL DATE OR DATE RANGE
Green Swamp, Colt Creek SP, Cypress Creek FDA, Cypress Creek Nature Preserve	May 11 - 12, 2021
Green Swamp, Colt Creek SP, Cypress Creek FDA, Cypress Creek Nature Preserve	May 14 - 15, 2021
Green Swamp, Colt Creek SP, Cypress Creek FDA, Cypress Creek Nature Preserve	May 17 - 19, 2021
Green Swamp, Colt Creek SP, Cypress Creek FDA, Cypress Creek Nature Preserve	May 24 - 26, 2021
Green Swamp, Colt Creek SP, Cypress Creek FDA, Cypress Creek Nature Preserve	May 28 - 29, 2021
St. Marks National Wildlife Refuge	13-Apr-21
Big Bend WMA, Spring Creek Unit	April 16 - 19, 2021

Aucilla WMA, Flint Rock Tract	April 20 - 22, 2021
St. Marks NWR, Aucilla WMA, Flint Rock Tract	April 23 - 26, 2021
Big Bend WMA, Spring Creek Unit	April 27 - 29, 2021
St. Marks NWR, Aucilla WMA, Flint Rock Tract	May 1 - 3, 2021
Big Bend WMA, Spring Creek Unit	May 4 - 6, 2021
St. Marks NWR, Aucilla WMA, Flint Rock Tract	May 7 - 10, 2021
Big Bend WMA, Spring Creek Unit	May 11 - 13, 2021
St. Marks NWR, Aucilla WMA, Flint Rock Tract	May 14 - 17, 2021
Big Bend WMA, Spring Creek Unit	May 18 - 20, 2021
St. Marks NWR, Aucilla WMA, Flint Rock Tract	May 21 - 24, 2021
Big Bend WMA, Spring Creek Unit	May 25 - 27, 2021
Lake Woodruff NWR, Charles Bronson SF, Lake George SF	April 16 - 22, 2021
Lake Woodruff NWR, Charles Bronson SF, Lake George SF	April 23 - 29, 2021
Lake Woodruff NWR, Charles Bronson SF, Lake George SF	April 30 - May 7, 2021
Lake Woodruff NWR, Charles Bronson SF, Lake George SF	May 8 - 14, 2021
Lake Woodruff NWR, Charles Bronson SF, Lake George SF	May 15 - 21, 2021
Lake Woodruff NWR, Charles Bronson SF, Lake George SF	May 22 - 28, 2021
Lake Woodruff NWR, Charles Bronson SF, Lake George SF	May 29 - June 4, 2021
Seminole State Forest	April 18 - 22, 2021
Lake Norris Conservation Area / Ocala NF	May 2 - May 6, 2021
Seminole State Forest	May 9 - May 13, 2021
Lake Norris Conservation Area / Ocala NF	May 16 - May 22, 2021
Seminole State Forest	May 23 - May 27, 2021
Lake Norris Conservation Area / Ocala NF	May 31 - June 3, 2021
Seminole State Forest	June 6 - June 8, 2021



**FIGURE 1: PHOTO OF DUKES' SKIPPER HABITAT AND HOST SEDGE AT CYPRESS CREEK FLOOD DETENTION AREA (OCT 15, 2021).**

During the spring 2021 survey season, a total of two (2) Dukes' skippers were found. Both were at locations previously documented for this butterfly. The first was found on April 12th at the Tide Swamp Unit of the Big Bend Wildlife Management Area. The second was found on May 11th within the Green Swamp Wildlife Management Area of Withlacoochee State Forest.

Dukes' Skipper Fall 2021 Surveys were conducted from the July through October timeframe at the following conservation land areas listed below. The number of surveys conducted on each of these lands during fall 2021 is listed after its name.

- 1) Aucilla Wildlife Management Area – 2 surveys
- 2) Chassahowitzka Wildlife Management Area - 5 surveys
- 3) Cypress Creek Nature Preserve, Tampa – 1 survey
- 4) Cypress Creek Flood Detention Area (Pasco County) – 2 surveys
- 5) Gulf Hammock Wildlife Management Area / Waccasassa Bay – 3 surveys
- 6) Half Moon Wildlife Management Area – 3 surveys
- 7) Lake Marion area / Cypress Parkway ditches – 1 survey
- 8) Rolling Meadows / Lake Hatchineha Shoreline hammocks – 2 surveys
- 9) Seminole State Forest – 2 surveys
- 10) St. Marks National Wildlife Refuge – 2 surveys
- 11) Big Bend Wildlife Management Area (WMA), Jena and Tide Swamp Units – 3 surveys
- 12) Colt Creek State Park – 1 survey
- 13) Lower Suwannee National Wildlife Refuge – 1 survey
- 14) Seminole Ranch Conservation Area – 3 surveys
- 15) Withlacoochee State Forest, Richloam Tract – 10 surveys

The following conservation lands were targeted for Dukes' skipper surveys during the July through October timeframe although there were no recent Dukes' skipper records on any of these targeted lands. These butterfly surveys were conducted by a combination of 1) a field researchers employed by the Florida Museum of Natural

History, University of Florida, 2) citizen scientist volunteers who accepted survey locations assigned to them, and 3) other competent field biologists and private citizens who could not commit to any formal survey assignments or survey protocols but whose knowledge and participation would help this project meet its goal and objective of developing a comprehensive and more current picture of the distribution of Dukes' skippers in Florida.

The primary difference among these different participant groups is that citizen scientist volunteers would keep detailed information about their involvement with their Dukes' skipper surveys. This allows the project to provide an accurate accounting of the amount of survey time and volunteer effort in fulfilling the terms of this grant.

There were two individuals in the first category, three individuals in the second category, and four individuals in the third category. For various personal, health, or scheduling problems, some individuals who participated during the spring 2021 surveys did not participate in the fall 2021 Dukes' skipper surveys. Nevertheless, this group of surveyors made significant finds during the fall 2021 surveys

### Results from 2021 Surveys

During the fall 2021 survey season, there was a total of 202 Dukes' skippers sighted. This represented significantly higher numbers than in the spring. The sightings were split into two geographic areas. Two were found at the Tide Swamp Unit of the Big Bend WMA, with one being seen on July 30<sup>th</sup> and the other one on August 26<sup>th</sup>. These two sightings do not fall within the time period typically identified as the flight period for the *Euphyes dukesi calhouni* taxon, although Shuey (1996) does note that there is a Florida record for this butterfly in July.

All the other 200 Dukes' skippers found during these fall surveys were in the central-western Florida peninsula. Most were in the Richloam Tract of the Withlacoochee State Forest, an area documented for this butterfly during the 2015 – 2016 surveys for this butterfly. Three additional individuals were found at Colt Creek State Park in Polk County and a single individual was found at the Cypress Creek Flood Detention Area (CCFDA) in Pasco County. The CCFDA record represents the first documented sighting at that location since the 1990's.

There were no Dukes' skipper found during the fall 2021 surveys at any of the central-eastern Florida peninsula sites where this butterfly has been sighted in earlier years.

A total of 16 conservation land were surveyed for Dukes' skippers during fall 2021. Five of those 16 lands have had Dukes' skipper records during the last five to ten years. The Dukes' skipper found this fall at the CCFDA is a confirmation that the butterfly may still persist at locations from which it was last documented in the 1990's. The remaining 10 properties that surveyed this fall warranted additional searches for Dukes' skippers although there remains no concrete evidence for the presence of this butterfly on those properties at the current time.

### 2022 Surveys

A total of twenty (20) conservation land areas located across fourteen (14) Florida counties (Brevard, Citrus, Dixie, Hernando, Lake, Levy, Orange, Pasco, Pinellas, Polk, Seminole, Sumter, Taylor, and Volusia) were surveyed in 2022 (Table 1). It should be noted that these properties are extensive and cover more than 400,000 total acres. Known hotspots for Dukes' skippers in Green Swamp Wilderness Preserve and Withlacoochee State Forest (WSF) were heavily surveyed to help uncover the extent of habitat usage and connectivity of those population clusters. The knowledge gained from the Green Swamp/WSF population during the fall 2021 field season helped to inform researchers during exploratory habitat assessments, leading to a more refined approach in survey techniques being applied elsewhere in the field.

**TABLE 3. SUMMARY OF 2022 DUKES' SKIPPER SURVEYS LOCATIONS WITH DATES AND NOTATION OF PRESENCE OR ABSENCE ON THE PROPERTY.**

<b>Property Name</b>	<b>Date(s) Surveyed</b>	<b>Population Found on Property</b>
Chassahowitzka River and Coastal Swamps	6/19/2022, 10/6/2022	no
Chassahowitzka Wildlife Management Area	5/10/2022, 9/16/2022, 10/6/2022, 10/10/2022, 10/22/2022	Yes
Colt Creek State Park	5/30/2022, 9/2/2022, 9/15/2022, 9/18/2022, 9/22/2022, 10/7/2022	no
Cypress Creek Flood Detention Area	5/13/2022, 6/1/2022, 9/23/2022,	yes
Devil's Hammock Wildlife Management Area	9/22/2022	no
Fisch Tract - Seminole State Forest	5/16/2022, 5/17/2022	no
Green Swamp Wilderness Preserve	5/11/2022, 5/12/2022, 5/30/2022, 6/14/2022, 9/2/2022, 9/6/2022, 9/15/2022, 9/22/2022, 10/8/2022, 10/12/2022	yes
Jumper Creek Wildlife Management Area	6/19/2022	no
Withlacoochee State Forest		
Lake George State Forest	10/14/2022	no
Lake Norris Conservation Area	5/17/2022, 5/19/2022	no
Lake Woodruff National Wildlife Refuge	5/19/2022, 10/14/2022	yes
Little Big Econ State Forest	5/26/2022	no
Lower Suwanee National Wildlife Refuge	4/29/2022, 10/6/2022	yes
Pinellas County Private Properties	5/5/2022, 6/22/2022, 9/23/2022	yes



Richloam Tract - Withlacoochee State Forest	5/3/2022, 5/6/2022, 5/30/2022, 9/18/2022, 10/8/2022	yes
Rock Springs Run State Reserve	6/25/2022	no
Seminole Ranch Conservation Area	5/25/2022	no
Tide Swamp Unit Big Bend Wildlife Management Area	5/5/2022	yes
Tosohatchee Wildlife Management Area	5/24/2022, 5/25/2022, 5/26/2022	no
Wekiva Buffer Conservation Area	6/26/2022	no

During the 2022 season, Dukes' skipper observations were recorded from 3 May to 14 June (43 days) for the spring flight period and from 16 September to 22 October (37 days) for the fall flight period. Two new populations of Dukes' skippers were located and sampled during the 2022 spring field season. The first new population discovery occurred at Chassahowitzka Wildlife Management Area in Hernando County on May 10, 2022 (Fig. 2). The second population was discovered at Lake Woodruff National Wildlife Refuge in Volusia County on May 19, 2022.



**Figure 2.** First Dukes' skipper documented at Chassahowitzka WMA in 2022.

Hurricane Ian had a significant impact on fall 2022 surveys. Although the spring season offered excellent survey conditions, fall conditions were much different. On September 28th, 2022, Hurricane Ian made landfall in southwest Florida and began its destructive path across the state. This was the peak of the fall brood's flight period, so adults, eggs, and larvae were potentially impacted. Ian traveled over many of the floodplain basins and hammocks that were targeted for fall surveys, causing record flooding at survey sites in Orange, Volusia, and Seminole counties. Pre-hurricane storms had already saturated the soils in mid- September, filling area floodplains. The additional rainfall totals from Ian resulted in extended inundation of the host plant material and rendered surveys too hazardous to complete for the remainder of the expected fall flight period for Dukes' skippers in east-central Florida. For these reasons, Charles H. Bronson State Forest, Lake George State Forest (Dexter/Mary Farms Tract), Lake Woodruff National Wildlife Refuge, Seminole State Forest (Fisch Tract), Tosohatchee Wildlife

Management Area, and Wekiva River Buffer Conservation Area could not be surveyed adequately or safely during the fall flight period. An attempted survey at Lake George State Forest on October 14, 2022, revealed that flooding was still too severe to access Dukes’ skipper habitat in Volusia County. As of mid-October, several survey properties were either closed for public safety, or had limited accessibility due to road closures and flooding.

Although a small number of Dukes’ skippers were observed along roadside areas with ample available flowers, the vast majority were found with the boundaries of hydric hammock habitat with abundant *Rhynchospora* host sedge (Fig. 3). They display high levels of fidelity to their host sedge stands if nectar resources can be found within them. That said, if available nectar resources are insufficient, adult skippers may travel significant distances outside of the habitat boundary. During the surveys, technicians and volunteers observed one adult at least 700 meters from the closest hydric hammock and into adjacent more upland even scrubby or sandhill habitat areas. This supports the possibility that adult skippers can disperse to find available resources and may be able to colonize adjacent suitable habitat locations if available.



**FIGURE 3. RICHLOAM HABITAT SHOWING EXTENSIVE STANDS OF *RHYNCHOSPORA* HOST SEDGE. OVER 80 SKIPPERS WERE COUNTED AT THIS 10-ACRE CLUSTER ON A SINGLE DAY IN OCTOBER 2021.**

A total of 68 non-destructive genetic samples were collected from multiple sites among the properties surveyed (Table 4; Fig. 4, Fig. 5). A photo voucher of the specimen was taken for 64 out of the 68 samples collected (see Appendix A).

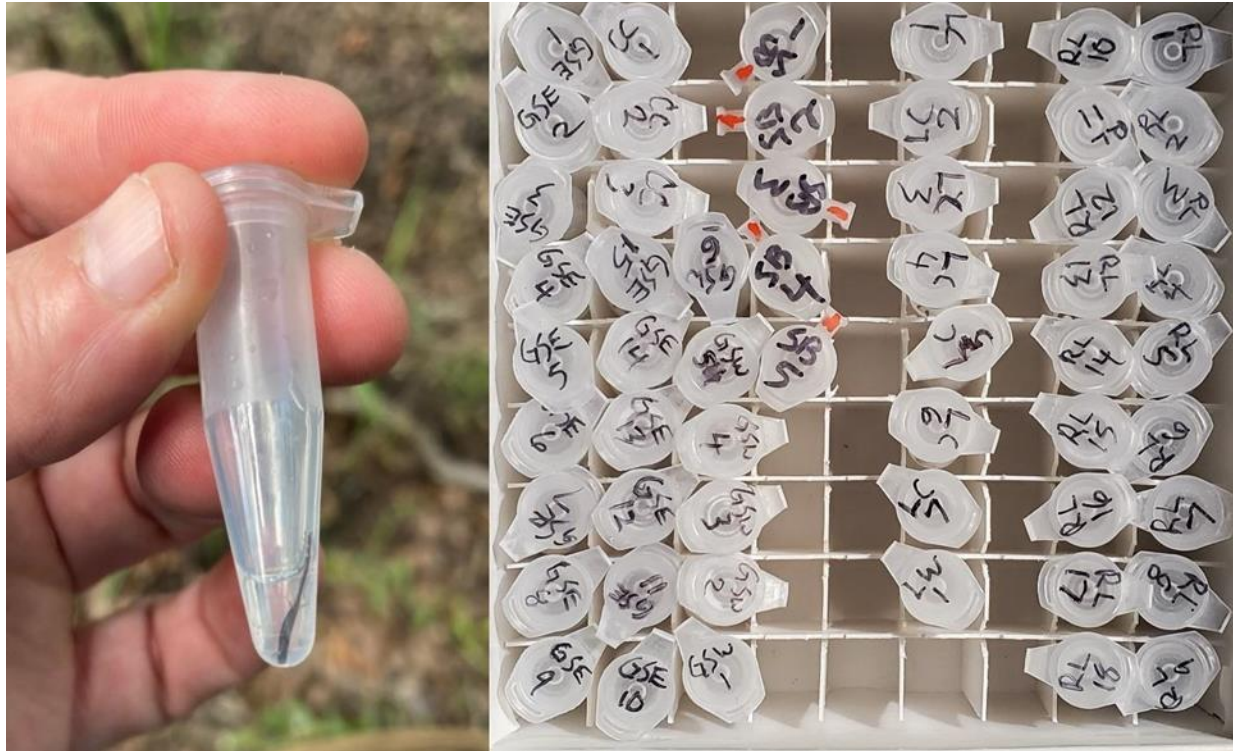
**Table 4.** Location of non-destructive genetic samples and number of collected per property.

<b>Conservation Property or other Location</b>	<b>No. Non-destructive Samples Collected</b>
Green Swamp Wilderness Preserve/ Richloam Tract of Withlacoochee State Forest	44
Lakeview Church (Pinellas County)	11

Cypress Creek Flood Detention Area	5
Chassahowitzka WMA	5
Big Bend WMA	1
Lake Woodruff NWR	1
Lower Suwanee NWR	1



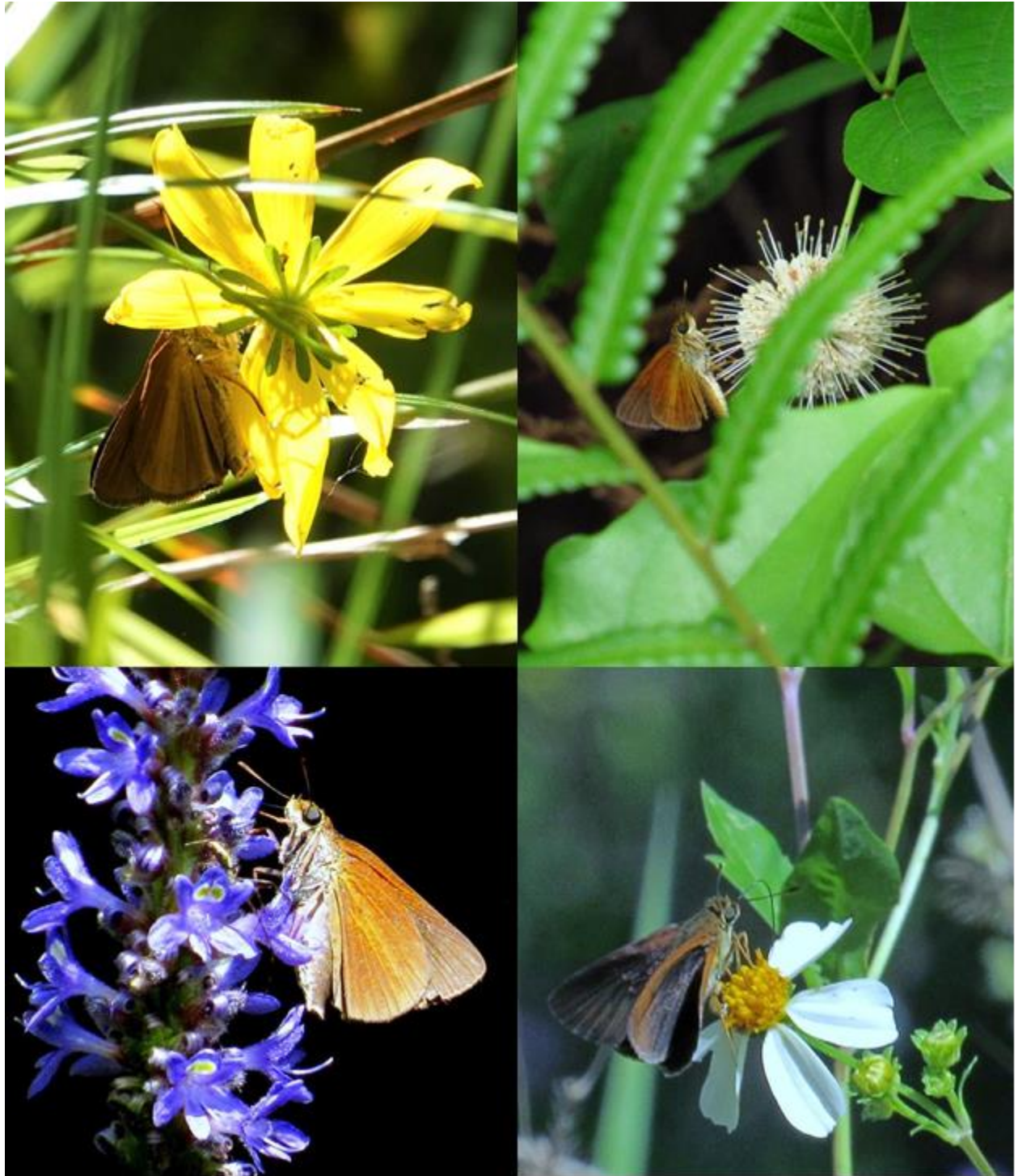
**FIGURE 4. FIELD TECHNICIAN REMOVES SINGLE LEG FROM AN ADULT DUKES' SKIPPER. THIS REPRESENTS A VIABLE, NON-DESTRUCTIVE TISSUE SAMPLING TECHNIQUE FOR LEPIDOPTERA.**



**FIGURE 5. TISSUE SAMPLE (SINGLE LEG) IN LYSIS BUFFER IN SMALL SNAP TOP EPPENDORF TUBE (LEFT) AND BOX OF LABELLED SAMPLES (RIGHT). ALL SAMPLES ARE TRANSPORTED BACK TO THE FLORIDA MUSEUM OF NATURAL HISTORY FOR DNA EXTRACTION.**

Adult Nectar Resources

Dukes' skippers have been found nectaring on various plant species (Fig. 6) including *Bidens alba*, *Bidens mitis*, *Cephalanthus occidentalis*, *Pontederia cordata*, *Mikania scandens*, *Desmodium paniculatum*, *Elephantopus carolinianus*, *Carphephorus corymbosus*, and a *Solidago* species. Having a local distribution of *C. occidentalis* is a bonus for spring broods, but *P. cordata* is consistently a favorite for both spring and fall broods. *Bidens mitis* grows directly among the host plant, making it a vital nectar resource at some locations, like Chassahowitzka WMA in Herndando County. In contrast, *B. alba* will generally grow in drier disturbed soils, like road embankments and mowed right of ways. *Desmodium paniculatum* is a weedy roadside plant that is common in Green Swamp and the Richloam Tract of Withlacoochee State Forest but is not a common nectar choice. *Elephantopus carolinianus* blooms in fall and can be common along the forest roads near Dukes' skipper habitat. *Mikania scandens* is very common across the state but will predominantly contribute to the fall brood instead of the spring. At Cypress Creek Flood Detention Area, *M. scandens* might be a substantial part of the butterfly's nectar diet in the fall.



**FIGURE 6. DUKES' SKIPPERS NECTARING. A.) A DUKES' SKIPPER NECTARS FROM *BIDENS MITIS* AT CHASSAHOWITZKA WMA; B.) A DUKES' SKIPPER NECTARS FROM *CEPHALANTHUS OCCIDENTALIS* IN GREEN SWAMP; C.) A DUKES' SKIPPER NECTARS ON *PONTEDERIA CORDATA* IN RICHLOAM WMA; D.) A DUKES' SKIPPER NECTARS FROM *BIDENS ALBA* IN RICHLOAM WMA.**

## Locations Supporting Dukes' Skipper Populations

1. **Green Swamp Wilderness Preserve (East and West Tracts)** – With contiguous wilderness stretching for 105,235 acres, Green Swamp is a stronghold for Dukes' skippers. Dozens of individuals were observed here throughout the season. Six DNA samples were collected from the west tract, while 17 were collected from sites in the east tract. The west tract is not as suitable, but a small remnant population cluster was found in May 2022. Ideal conditions are present in large portions of the east tract. Both tracts may have continued groundwater pump stations that alter the water table, affecting some Dukes' habitat in the process. How this will impact the long-term population stability is unclear without more intensive monitoring.
2. **Richloam Tract of Withlacoochee State Forest** – Positioned to the north of Green Swamp, the Richloam Tract is over 58,000 acres of contiguous wilderness stretching across multiple counties. Like Green Swamp, the best habitat lies east of SR 471. However, the habitat patches here have less connectivity than the east tract of Green Swamp. Around 130 Dukes' skippers were observed here on October 12, 2021. In spring 2022, dozens of skippers were observed, but it is estimated that only 15-25% of the fall 2021 numbers were observed at the same locations. In total, 21 DNA samples were collected from multiple population clusters in the Richloam Tract throughout 2022. Although the area is open to the public year-round for off-roading activities and for hunting, forestry activities pose the most risk to vital Dukes' skipper habitat.
3. **Lake Woodruff National Wildlife Refuge** – Located in Volusia County, Lake Woodruff NWR contains 21,159 acres of protected lands. The floodplain swamps along the southern shore of Spring Garden Lake hold minimal Dukes' skipper habitat, yet one individual was observed and captured there in May. There is a large strip of mixed hardwood wetlands that should be surveyed to rule out other potential Dukes' habitat on-site. Surveys will be expanded in this area to other nearby conservation lands.
4. **Chassahowitzka Wildlife Management Area** – Located in Hernando County, Chassahowitzka WMA contains 27,264 acres of protected wilderness. A large portion of the property is coastal swamp. It is difficult to survey here because of the particularly deep mucky soils that surround Dukes' skippers' territory. The swamps containing proper habitat have not been disturbed in over 100 years, leading to a closed canopy with few nectar resources. Although the Dukes' skipper was found here in May 2022, the extent of their range within the park's boundaries is unclear and will require a dedicated effort to understand. An estimated 15 Dukes' skippers were found here in the spring months. During the fall surveys, a total of 5 DNA samples were collected but fewer numbers were observed. In October 2022, multiple Dukes' skippers were located

nearly a mile outside of their typical habitat while taking advantage of *Carphephorus corymbosus* nectar. This uncharacteristic migration toward sandhill habitat suggests that nectar resources within the swamps are limiting and the population may be stressed.

5. **Lakeview Church/Crescent Oaks Community Properties** – This site is comprised of multiple adjoining properties totaling around 125 acres of mixed hardwood wetland habitat in the heart of suburbia. Permission was granted to survey two parcels belonging to the Lakeview Church and the Crescent Oaks Community Development located in Pinellas County Florida. A surprisingly high density of Dukes’ skippers was observed within the small areas surveyed here. At least 15 individuals were observed feeding on pickerelweed and buttonbush in the spring. Another 15-20 individuals were observed in the fall season. Eleven DNA samples were collected for analyses. This population has very few options for local migrations. Small patches of habitat might exist nearby at Brooker Creek Nature Preserve, but migration through urban development seems unlikely for this species at this location. Other Dukes’ skipper populations in Pinellas County are now extinct due to habitat loss. Because of its geographic isolation and limited size, the Lakeview Church population is also vulnerable to extinction. Given the proximity of this population to urban development, including a golf course, pesticide and herbicide drift may be a threat here. It is suggested that landowners be made aware of the importance of the wetland they share a section of in hopes it is protected from destruction.
  
6. **Cypress Creek Flood Detention Area** – Located in Pasco County, Cypress Creek FDA is an active well field containing 7,475 acres of conservation land. After one Dukes’ skipper was observed here in the fall of 2021, return trips were made to determine the extent of the population along the limited floodplain habitat. Only one area was located that contained a small Dukes’ skipper population. During the spring season, three DNA samples were collected from this location and around eight individuals were observed in total. In the fall, flooding severely limited the amount of exposed host *Rhynchospora*, but 3 more individuals were spotted after hours of searching through the floodwaters. Two more DNA samples were collected in the fall, bringing the total to 5 samples from this population. The only nectar here seems to be *Mikania scandens*, which grows in small patches scattered around the edge of the cabbage palm embankment and raised knolls within the floodplain. Continued groundwater pumping and invasive west Indian marsh grass are two glaring threats to the limited Dukes’ skipper habitat that was located here. Water flowing into the habitat is regulated by Southwest Florida Water Management District via valves at flood gates, so the habitat’s natural hydroperiod is likely altered.
  
7. **Big Bend Wildlife Management Area (Tide Swamp Unit)** – The Tide Swamp Unit contains 19,538 acres of wilderness. Surveyors were able to locate one Dukes’ skipper feeding on *Bidens alba* near a roadway. It was captured and a DNA sample was collected. The habitat is coastal swamp with floodplain influences. Remnants of logging



canals and trams could be the main territory for the butterflies here, like in Chassahowitzka WMA.

8. **Lower Suwanee National Wildlife Refuge** – At 52,472 acres of conservation land, Lower Suwanee NWR is one of the largest properties in Florida with records of Dukes' skippers. Surveys were conducted in spring and fall of 2022 in areas of previous sightings. Only one Dukes' skipper was observed and sampled during the fall season at this location. Much of the property is coastal swamp with mucky soils, complex hydrology and long hydroperiods. Future survey trips will focus on DNA collection and expanding the known habitat.

#### Locations Where Dukes' Skipper Was Not Recorded in 2022

Although Dukes' skippers were reconfirmed at many locations, visual surveys at the sites of some previous observations were unsuccessful. Negative results at the locations of previous sightings could be explained by a contribution of many factors including, but not limited to habitat loss or alteration, small population sizes, organism detectability, phenology/timing of surveys, etc.

1. **Charles Bronson State Forest** – Sections of this property's 11,058 acres showed potential for Dukes' skippers, but none were observed during spring 2022 surveys. Previous sightings of Dukes' skippers at the adjacent Seminole Ranch Conservation Area lend credence for conducting surveys at Charles Bronson SF. *Rhynchospora careyana* was found in significant stands along Buscombe Creek (Fig. 7) and Christmas Creek floodplains. Better access into larger portions of hammock exists near Christmas Creek, where large patches of pickerelweed are present. Due to the size of the property, more exploration is needed to locate prime habitat. No threats to this habitat were noted during spring 2022 surveys. Unfortunately, flooding caused by Hurricane Ian prevented further exploration during the fall season.



**FIGURE. 7. BUSCOMBE CREEK FLOODPLAIN HABITAT. ALTHOUGH ONLY SMALL AREAS OF HABITAT WERE DISCOVERED, THE IMPLICATIONS SUGGEST THAT MORE EXISTS AT LOWER ELEVATIONS FURTHER TOWARD THE ST. JOHNS RIVER**

2. **Lake Norris Conservation Area** – The property contains 2,351 acres of protected land bordering the east shores of Lake Norris. Patches of habitat exist scattered throughout the hydric hammocks bordering the lake (Fig. 8). There is a good chance that large stands of host sedge can be located on-site with future surveys. Unfortunately, no Dukes’ skippers were located here in spring of 2022.



**FIGURE 8. LAKE NORRIS HABITAT. PICKERELWEED GROWS IN ABUNDANCE WITHIN THE SEDGE STANDS. THE LARGEST STAND OF HOST SEDGE WAS LESS THAN ONE ACRE.**

3. **Fisch Tract of Seminole State Forest** – Much of Fisch tract’s 2,922 acres of wilderness lies along Blackwater Creek (Fig. 8). The lush floodplain habitat has large contiguous stands of *Rhynchospora* sedge and nectar resources, including all of the Dukes’ skipper’s favorite species. Miles of the floodplain was surveyed via kayak, but no skippers were located. A region of the Fisch Tract was accessed through the Sun Citrus Tract of SSF, near Lake Norris, but the habitat is rather limited by comparison. Kayaks or canoes provide access to much better survey sites. Access through the Cassia Trailhead gates leads to a launch site directly on Blackwater Creek. From the launch, the most habitat lies upstream and continues for miles on both sides of the waterways. This habitat is very similar to some sections of the Withlacoochee River system where Dukes’ skippers are found in abundance. Observations suggest that the skippers have an affinity for areas near flowing water, and this site has no shortage. Unfortunately, Hurricane Ian rendered surveys in this portion of the forest impossible during the fall flight period.



**FIGURE 8. BLACKWATER CREEK FLOODPLAIN HABITAT, SEMINOLE STATE FOREST. IN MOST PLACES, POTENTIAL DUKES’ HABITAT EXTENDS THE WIDTH OF THE FLOODPLAIN. NECTAR RESOURCES ARE ABUNDANT THROUGHOUT.**

4. **Seminole Ranch Conservation Area** – This property is the location of previous Dukes’ skipper sightings. Low numbers of Dukes’ skippers were observed near the Orlando Wetlands Park in the recent past by a volunteer, so surveys focused on those areas and a few additional small patches of poor habitat. No Dukes’ skippers were observed here

in spring 2022. Only a small percentage of the property's 29, 450 acres are potentially suitable for Dukes' skippers. Seminole Ranch Wildlife Management Area, an adjoining property, was not surveyed but could have some suitable wetlands. Dukes' skipper habitat could also exist on portions of Orlando Wetlands Park property adjacent to Seminole Ranch CA.

5. **Tosohatchee Wildlife Management Area** – This property is another location of previous Dukes' skipper sightings. Spring surveys revealed that the exposed drainage canal where Dukes' skippers were seen before was well outside of what is considered their preferred habitat in other locations in peninsular Florida. Floodplain habitats were surveyed throughout the property, and some were identified for future surveys. No Dukes' skippers were found here in spring of 2022. It is doubtful that ditches are chosen for egg-laying locations, but if so, regular mowing by land management poses a risk to population numbers at this location. If Dukes' skippers are located here in substantial numbers, the more protected floodplains along Power Line Rd are where they will most likely be. Large stands of host sedge (Fig. 9) and abundant nectar resources are present just a few miles from the previous sightings of the skippers. It is likely that observations here were of migrating or far-foraging individuals. This property lies directly to the south of Seminole Ranch CA, so there is potential for gene flow between the two populations of skippers, assuming the populations are still extant. Unfortunately, the flooding impacts to this region caused by Hurricane Ian were severe, preventing fall surveys at this location.



**FIGURE 9. JIM CREEK FLOODPLAIN AT TOSOHATCHEE WMA. LARGE EXPANSES OF POTENTIAL DUKES' SKIPPER HABITAT WERE LOCATED NEAR THE ST. JOHNS RIVER. THE JIM**

**CREEK FLOODPLAIN REPRESENTS THE BEST EXAMPLE OF HABITAT FOUND ON THE PROPERTY DURING SPRING 2022 SURVEYS.**

6. **Little Big Econ State Forest** – The small sections of hammock within the western portion of Little Big Econ SF were surveyed in spring of 2022. The surveys revealed that the property’s 10,336 acres of conservation lands are not suitable for Dukes’ habitat. The area is much too dry. Floodplains within the property do not have shallow banks with the mucky soils required for host sedges to flourish.
7. **Rock Springs Run State Reserve** – Rock Springs Run SR is a property with 14,165 acres of conservation lands. Sections of the property were surveyed but no habitat was located on the single trip to the property. Subsequent soil mapping helped to identify target areas near Buffalo Tram Rd. Surrounding properties like Wekiwa Springs State Park also show signs of potential habitat. Tram roads will provide the quickest access into the hammocks but reaching them will require off-road vehicles.
8. **Wekiva River Buffer Conservation Area** – Located to the east of Rock Springs Run SR, this property is 2,480 acres of floodplain habitat. Potential Dukes’ skipper habitat (Fig. 10) was located here via the entrance at Sabal Point Sanctuary Trail. Quality habitat is located on the east side of the trail 1.5 miles in from the parking area. The east side has lots of wetlands and pockets of *Rhynchospora*. The west side of the trail is mostly higher in elevation with more cabbage palms. The habitat tended to improve from west to east, so it is likely that better habitat exists closer to the Little Wekiva River. Unfortunately, the flooding impacts to this region caused by Hurricane Ian were severe, preventing fall surveys at this location.



**FIGURE 10 WEKIVA RIVER BUFFER HABITAT. TUCKED AWAY IN THE DENSE HAMMOCK ARE POCKETS OF POTENTIAL DUKES' SKIPPER HABITAT. A COMPARISON TO THIS HABITAT IS CHASSAHOWITZKA WMA ON THE GULF COAST, WHERE A NEW POPULATION WAS DISCOVERED IN 2022.**

9. **Jumper Creek Wildlife Management Area in Withlacoochee State Forest** – Located southwest of Lake Panasoffkee, much of Jumper Creek's 10,000 acres could be potential Dukes' skipper habitat. Severe weather impacted surveys at this location, so return trips are needed. Only a small section of the property was covered, but multiple areas have been identified for future surveys.
  
10. **Chassahowitzka River and Coastal Swamps** – Just to the north of Chassahowitzka WMA, is Chassahowitzka River and Coastal Swamps. Due to its proximity to the recent discovery at Chassahowitzka WMA, this location is expected to have similar conditions. The property was scouted in spring and fall, and additional survey locations were identified for future efforts. Pockets of habitat are likely hiding somewhere in the hammock, but it will take more time and resources to locate it. Access into the swamps is available through Withlacoochee State Forest gates and along W Burnt Bridge Rd, but entry on foot is required to reach habitat deep into the hammock.
  
11. **Colt Creek State Park** – The park is 5,067 acres in size, but habitat is limited. Dukes' skippers have been recorded at Colt Creek SP in two locations. The most recent fall 2021 sightings were associated with the Gator Creek floodplain near SR 471. A more distant 2016 Dukes' sighting was observed near the horse campgrounds close to a dome swamp. Extreme flooding completely inundated and covered the known patches of

host plants within the park from mid-September through mid-October. *Bidens alba* patches near Gator Creek have been a source of nectar for the skippers in the past, but no Dukes' skippers were observed in 2022 at Colt Creek State Park.

12. **Devil's Hammock Wildlife Management Area** – This WMA contains over 7,000 acres of conservation lands. Much of the property consists of flat floodplain soils that are deep and poorly drained. Host plant habitat was identified in September 2022, but more exploration is needed to detect Dukes' skipper here.
13. **Lake George State Forest** – After discovering one Dukes' skipper in May of 2022 at Lake Woodruff National Wildlife Refuge, the adjacent Dexter/Mary Farms Tract of Lake George State Forest was identified as a possible population hub. The lone Dukes' skipper from Lake Woodruff NWR may have traveled south from Lake George SF. Attempts were made to access portions of the Deep Creek Canal floodplain, but due to Hurricane Ian's impacts, the property remained too flooded to access safely during the fall 2022 season (Fig. 11).



**FIGURE 11. LAKE GEORGE STATE FOREST FLOODING. ON 10/14/2022, FLOOD WATERS PREVENTED RESEARCHERS FROM ENTERING THE HYDRIC HAMMOCKS IN SEARCH OF DUKES' SKIPPERS.**

### Takeaways

Based on observations over three field seasons, Dukes' skippers likely have a flight window in central Florida between 35 and 45 days each spring and fall that loosely coincides with the arrival and departure of the seasonal monsoons. Traditionally, the rainy season in Florida runs from mid-May to October, with June and August being the wettest months. It is assumed that flight periods are similar between the spring and fall broods, although nectar resource availability is not consistent between spring and fall.

A total of 105 individuals were recorded from 7 properties in spring 2022. By contrast, only 39 individuals were recorded across 5 properties in fall 2022. This reduction was due to the impacts of Hurricane Ian which curtailed access to many properties and restricted survey time.

Based on field observations, mesic habitats that have a slope of over 2°, have peak hydroperiods shorter than 4 months, and lack deep mucky soils are not as likely to develop large rhizomal stands of their preferred host *Rhynchospora* spp. such as *R. inundata* or *R. careyana*.

Researchers/land managers should be looking for flat mucky drainage soils in floodplains and swamps with hydroperiods of at least 4-6 months. The clumping sedge, *Rhynchospora miliacea*, does not appear to be an attractive host species for the butterflies in central Florida. No Dukes' skippers were found on *R. miliacea* in three seasons of in situ observations. The smaller *R. miliacea* prefers habitat slightly higher in elevation than the clonal varieties and is usually much less abundant. Healthy host sedge patches of 0.5 acres or greater seem to concentrate and hold more Dukes' skippers.

Canopy cover seems to strongly influence Dukes' skipper presence in a give habitat. Increased canopy cover significantly impacts understory growth (Figure 12) and the availability of key adult resources such as nectar, so there becomes an underlying need for regenerative disturbances, like fire. It may be



possible to improve Dukes' skipper habitat with a combination of prescribed fire and selective tree thinning, which would open the understory for nectar plants to recolonize.



**FIGUER 12. DENSE CANOPY LIMITS NECTAR. CANOPY COVER OF THIS AGE AND DENSITY PREVENT QUALITY NECTAR RESOURCES FROM THRIVING AT CHASSAHOWITZKA WMA.**

### **Appendix A – Photo Voucher Guide**

Voucher photos were taken for all adult Dukes' skippers from which nondestructive tissue material was collected. Individuals without voucher photos are listed under the property heading (Fig. 13).



**FIGURE 13. FIELD RESEARCH TAKING PHOTOGRAPH VOUCHER FOR ADULT DUKES' SKIPPER SPECIMENS AT CYPRESS CREEK FLOOD DETENTION AREA IN MAY 2022.**

**Cypress Creek Flood Detention Area (CC#)**

\*No photos of CC2

CC1 5/13/2022



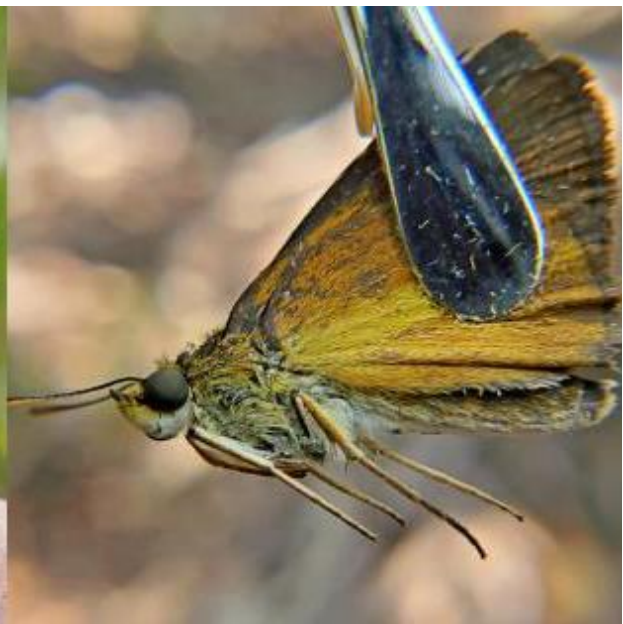
CC3 5/13/2022



CC4 9/23/2022



CC5 9/23/2022



**Chassahowitzka Wildlife Management Area (Ch#)**

Ch1 9/16/2022



Ch2 9/16/2022



Ch3 9/16/2022



Ch4 9/16/2022



Ch5 10/22/2022



**Green Swamp Wilderness Preserve West Tract (GSW#)**

GSW1 5/12/2022

GSW2 5/12/2022



GSW3 5/12/2022



GSW4 5/12/2022



GSW5 5/12/2022



GSW6 5/12/2022



**Green Swamp Wildlife Management Area East Tract (GSE#)**

GSE1 5/11/2022



GSE2 5/11/2022



GSE3 5/11/2022



GSE4 5/11/2022



GSE5 5/11/2022



GSE6 5/11/2022



GSE7 5/11/2022



GSE8 5/11/2022





GSE9 5/11/2022



GSE10 5/12/2022



GSE11 5/12/2022



GSE12 5/12/2022



GSE13 5/12/2022



GSE14 5/12/2022



GSE15 5/12/2022



GSE16 5/12/2022



GSE17 9/15/2022



**Lake Woodruff National Wildlife Refuge (LW#)**

LW1 5/19/2022



Lakeview Church/Crescent Oaks Development Property-Pinellas County  
(LC#)

LC1 5/5/2022



LC2 5/5/2022



LC3 5/5/2022



LC4 5/5/2022



LC5 5/5/2022



LC6 5/5/2022



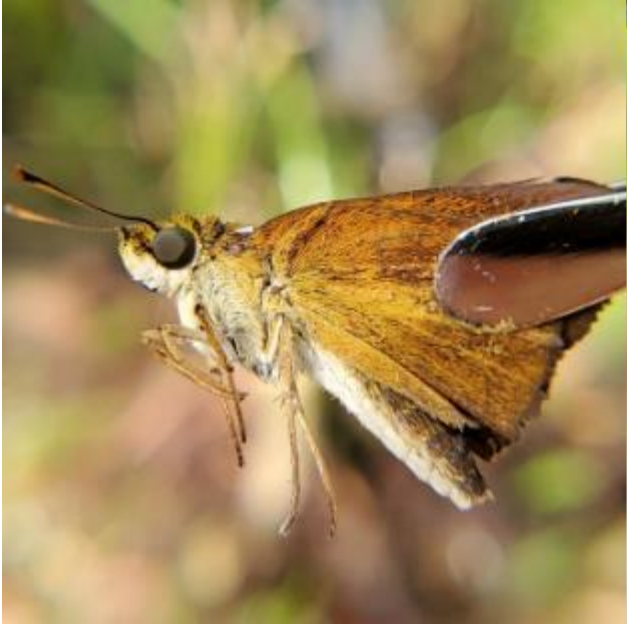
LC7 5/5/2022



LC8 9/23/2022



LC9 9/23/2022



LC10 9/23/2022



LC11 9/23/2022



**Richloom Tract - Withlacoochee State Forest (RL#)**

\*No photos of RL7

RL1 5/3/2022



RL2 5/3/2022



RL3 5/3/2022



RL4 5/3/2022



RL5 5/6/2022



RL6 5/6/2022



RL8 5/6/2022



RL9 5/6/2022





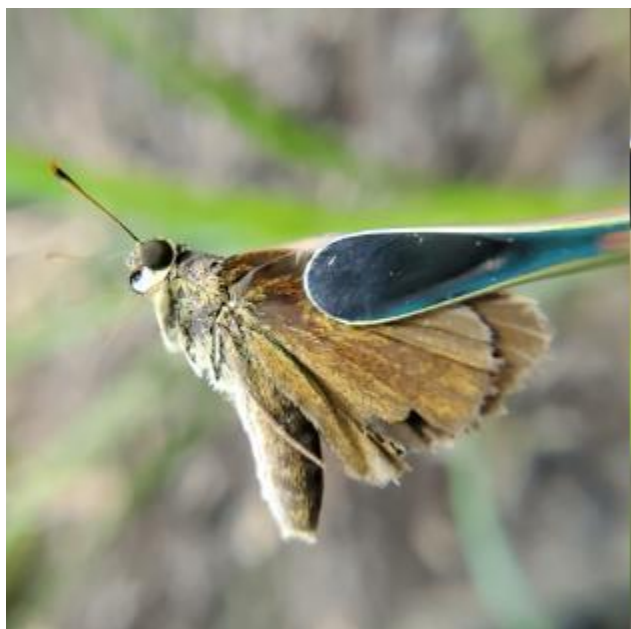
RL10 5/6/2022



RL11 5/30/2022



RL12 5/30/2022



RL13 5/30/2022



RL14 5/30/2022



RL15 5/30/2022



RL16 5/30/2022



RL17 5/30/2022



RL18 5/30/2022



RL19 10/8/2022



RL20 10/8/2022



RL21 10/8/2022

