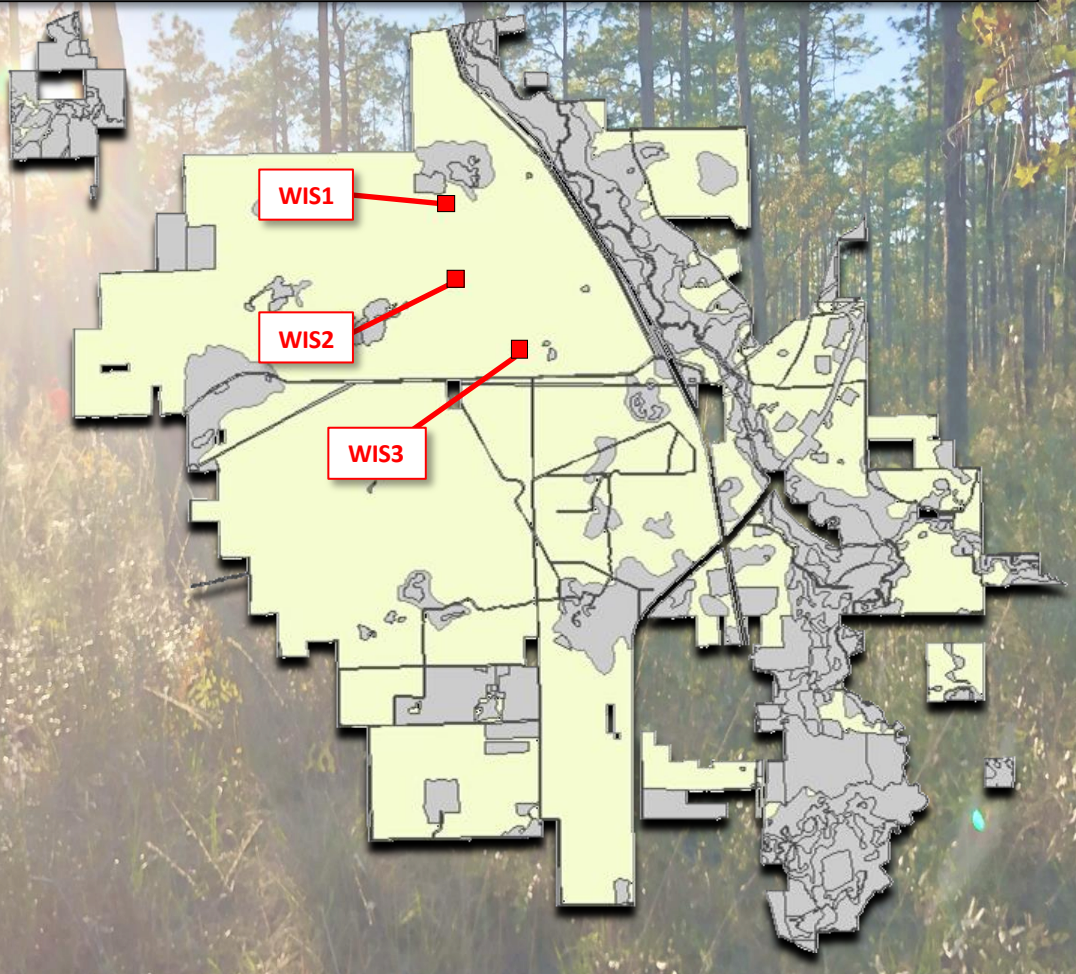
Plant-Pollinator Networks in Fire-Maintained Sandhills

Research Study (2019-2020)

Withlacoochee State Forest – Croom Tract

Site-specific results



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Plant: Solidago odora
Pollinator: Ammophila procera

Introduction

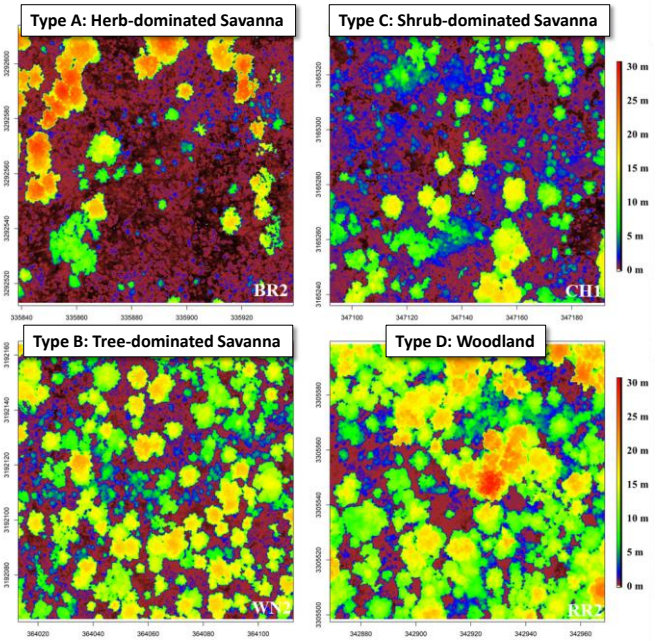
In Florida's fire-dependent longleaf pine savannas, as in terrestrial ecosystems worldwide, the mutualistic interaction networks formed by flowering plants and pollinators are of fundamental importance for the maintenance of biodiversity (Bascompte and Jordano 2007). Florida is part of the North American Coastal Plain floristic province, which is considered a global biodiversity hotspot due to unusually high vascular plant diversity and endemism (Noss et al. 2015). The pollinating insects of longleaf pine savannas likely play a central role in maintaining this high overall biodiversity, and they are also a diverse group in their own right, representing several prominent insect orders: Lepidoptera (butterflies and moths), Hymenoptera (bees and wasps), Coleoptera (beetles), and Diptera (flies) (Spiesman & Inouye 2013). Despite their ecological importance, the plant-pollinator networks of longleaf pine savannas have received little study (Spiesman & Inouye 2013). The purpose of this project is to begin filling critical baseline data gaps regarding plant-pollinator networks in Florida's fire-maintained uplands and their relationships to vegetation management.

Methods

24 1-hectare (2.5-acre) study plots were located at nine different fire-managed sandhill preserves in North-Central Florida: Ft. White WEA, Bell Ridge WEA, River Rise Preserve State Park, Jennings State Forest, Black Creek Ravines Conservation Area, Ordway-Swisher Biological Preserve, two separate tracts of Withlacoochee State Forest, and Chassahowitzka WEA. The study sites were carefully selected according to several criteria, including: 1) Frequent and ongoing prescribed fire, in most cases upwards of 20 years; 2) No history of intensive agriculture or plantation forestry; 3) Old growth species in the understory indicative of low soil disturbance (i.e. wiregrass, various wildflowers); and 4) Approximately one year since the last prescribed fire.

Within each preserve, two to three 1ha sampling plots were established at least 1km apart. Plant species composition was assessed in a grid of 25 5m x 5m quads. Species-specific flower abundance counts were conducted monthly from March 2019 – October 2019 along two transects (E-W and N-S) and in five 10m x 10m quads. Plant-pollinator interactions were sampled monthly using a 2hr timed transect sampling method. Every time the observer encountered an insect interacting with a flower, he or she captured the insect for identification and noted the plant species upon which it was encountered. Vegetation structure and surrounding landscape composition were assessed using LiDAR and aerial imagery via the GatorEye Unmanned Flying Laboratory.

One of the primary objectives of this study was to identify relationships between fire, vegetation structure, and plant-pollinator networks. To that end, we used LiDAR-derived Leaf Area Index (LAI) values to assess the density of four canopy strata beginning at 0.5m, which is the lowest height at which LAI can be reliably calculated from LiDAR: understory (0.5m – 1m), lowstory (1m – 3m), midstory (3m – 6m), and overstory (6m+). We used these data in conjunction with ground-collected percent herbaceous cover estimates to approximate the overall structure of each plot.

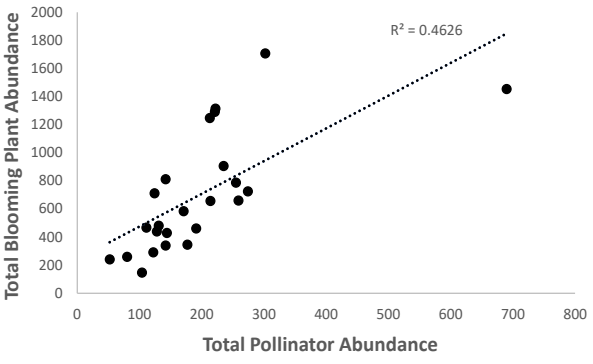


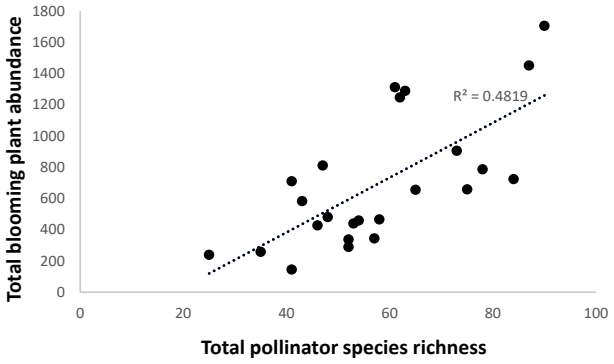
Overall Study Results: Vegetation Structure

Using multivariate statistical techniques to analyze the relative proportions of ground layer, shrub layer, and tree layer LAI, we identified four significantly different types of fire-maintained sandhill structures: Type A (herb-dominated savannas), Type B (tree-dominated savannas), Type C (shrub-dominated savannas), and Type D (woodlands). The images at left are visualizations of the LiDAR data, showing representative 1-ha plots belonging to each category.

Overall Study Results: Flower and Pollinator Abundance

Across the whole study, we found that flowering plant abundance was strongly correlated with total annual pollinator abundance and total pollinator species richness, and varied greatly across plots and seasons, with total flower abundance ranging from 145 to 1,707 blooming plants per plot.

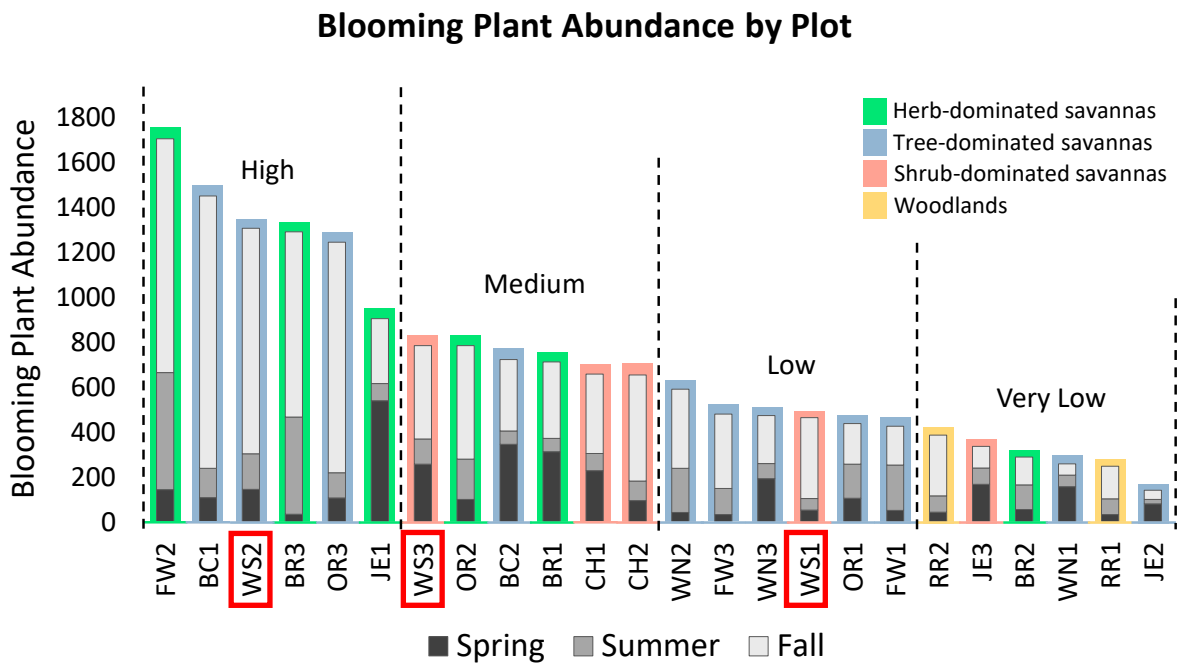




We found that the spring bloom season in longleaf pine sandhills is dominated by shrubs (particularly saw palmetto and blueberries), while the fall bloom season is dominated by herbaceous plants (especially members of the Asteraceae or sunflower family). Most of the herb-dominated plots in the study fell at the moderate to high end of the flower abundance range. Tree-dominated savanna plots had highly variable flower abundance, ranging from the lowest flower abundance to the second-highest, while shrub-dominated and woodland plots were somewhat less variable, ranging from very low to moderate flower abundance. Our habitat models showed that the abundance of individual flower-producing plants was only one predictor of actual flower production; tree-layer LAI had a significant negative influence on flower production, suggesting that even where appropriate understory plants are present, their flower production may be suppressed by higher levels of tree canopy LAI. *For a more detailed accounting of data analysis, conclusions, and management recommendations, check our FWRI/Upland Habitat website for publications and reports, which will be uploaded* https://myfwc.com/research/habitat/upland/.

Withlacoochee/Croom Results: Stand Structure and Flower Abundance

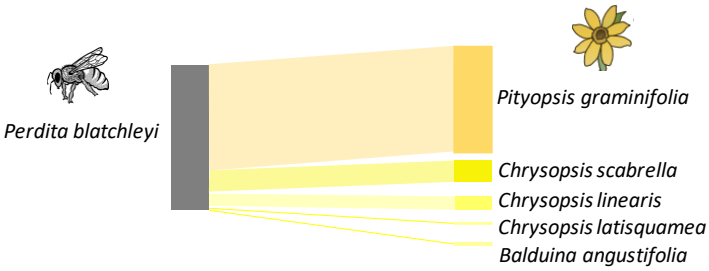
The Croom tract of Withlacoochee State Forest had one tree-dominated plot (WS2) and two shrub-dominated plots (WS1 and WS3). Plot WS2 had the third-highest blooming plant abundance in the study. Plot WS3 was also relatively high in blooming plant abundance, and was at the top of the Medium plant abundance quantile. Plot WS1, which was heavily oak-dominated, was in the low blooming plant abundance quantile. Many shrub species produce pollinator-attracting flowers, but oaks have wind-pollinated flowers and do not provide pollinator foraging habitat.



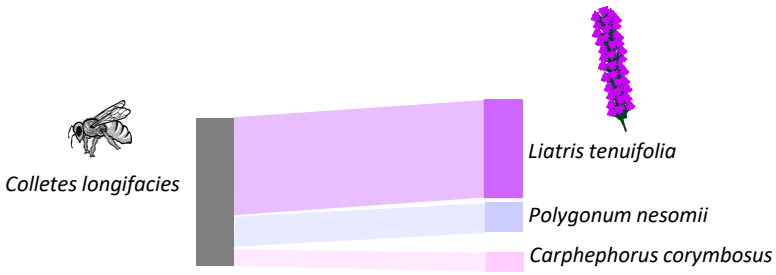
Withlacoochee - Croom Results: Pollinator Overview

The Croom tract of Withlacoochee State Forest had generally low to moderate overall pollinator abundance and species richness. The highest levels of species richness and abundance were found in plot WS2, which had above average Hymenoptera (Bee & Wasp) and Diptera (Fly) species richness and abundance. Lepidoptera (Butterfly & Moth) species richness and abundance were low to very low in all all three plots. Coleoptera (Beetle) species richness was low to very low in all three plots, though beetle abundance was moderate in plot WS2. Order-specific pollinator results are presented in greater detail on the following pages, followed by plant-pollinator network diagrams for each plot.

We found three bee Species of Greatest Conservation Need (SGCN) at Withlacoochee - Croom, including *Perdita blatchleyi, Caupolicana floridana*, and *Colletes longifacies.* We recorded enough observations of *P. blatchleyi* and *C. longifacies* in the overall study to draw conclusions about their flower preferences and make preliminary management recommendations. *P. blatchleyi* is a specialist on the closely-related plant genera *Pityopsis* and *Chrysopsis*, while *C. longifacies* appears to be less of a specialist, as we observed it interacting with the unrelated genera *Liatris* and *Polygonum*. Given the prevalence of interactions for the two SGCN bee species on *P. graminifolia* and *L. tenuifolia*, promoting flowering in these two plant species may be a good conservation target for improving *C. longifacies and P. blatchleyi* habitat. P. graminifolia's flower production and reproductive success are fire-induced and strongly influenced by season of burn, with spring and summer fires stimulating more flowers than winter fires (Brewer and Platt 1994). Both P. graminifolia and L. tenuifolia are sensitive to vegetation structure and become locally extirpated when shrub and tree cover become excessive. Management regimes that emphasize growing season fire and decrease woody dominance can be expected to favor these two SGCN bees.

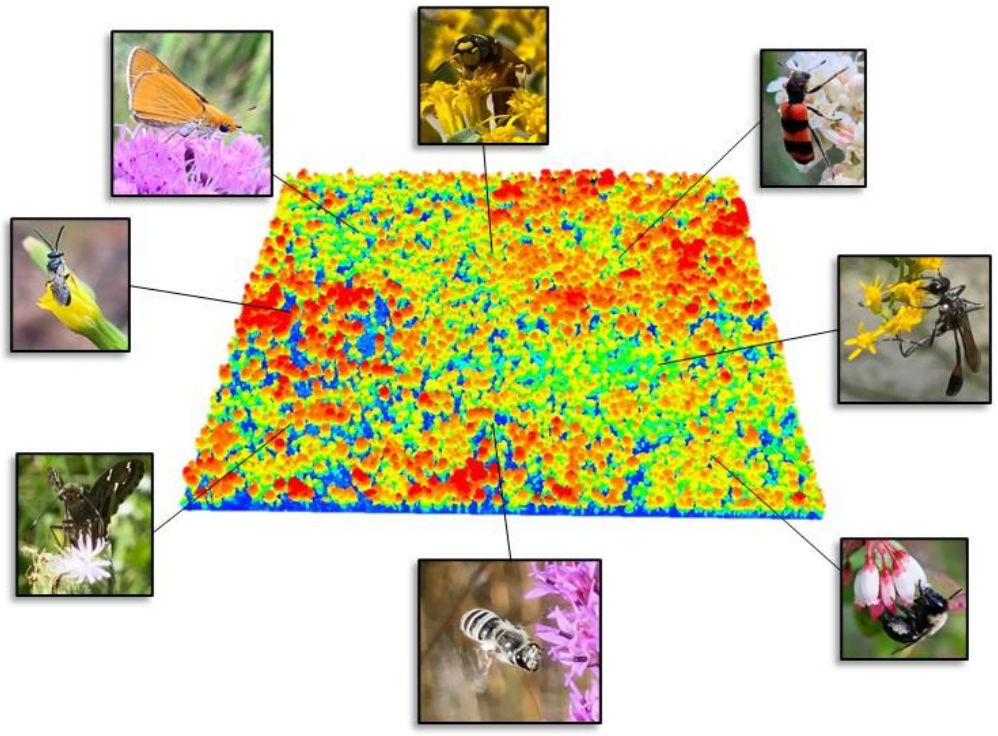


Flower interactions of *Perdita blatchleyi*, based on 103 observations recorded during the project.



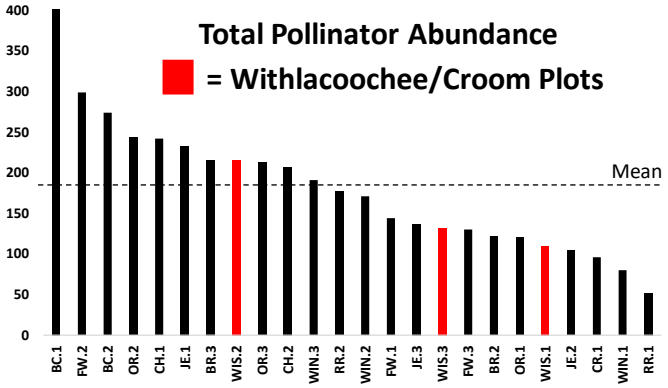
Flower interactions of *Colletes longifacies*, based on 24 observations recorded during the project.

Withlacoochee – Croom Tract Results
Pollinator Abundance and Species Richness



Overall Pollinator Abundance and Species Richness

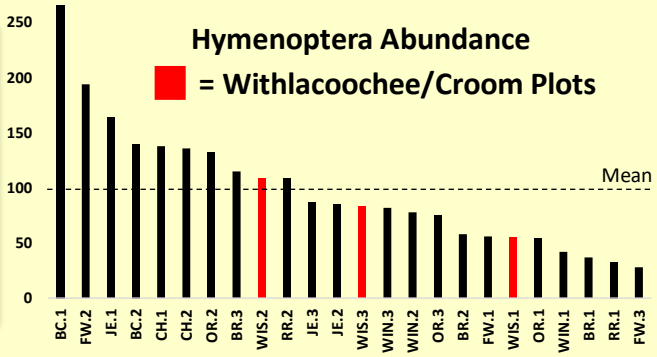
	Abundance # of individuals		Species Richness	
	Total	Rank	Total	Rank
Plot **WS1**	110	Med-Low	57	Med-High
Plot **WS2**	216	Med-High	60	Med-High
Plot **WS3**	132	Med-Low	46	Med-Low
Study Average	181.6		57.6	
Study Range	52 - 402		25 - 90	



The above table shows the total pollinator abundance (number of individual insects caught) and total pollinator species richness for the three study plots at the Withlacoochee Croom Tract, along with their rank relative to the entire 24-plot study. Plots within one Standard Deviation (SD) above the mean were ranked "**Medium-High**," and plots within one SD below the mean were ranked "**Medium-Low**." Plots >1 SD above the mean were ranked "**High**," and >1 SD below the mean were ranked "**Low**." Pollinator species richness was medium-high in plots WS1 and WS2, and medium-low in plot WS3. Total pollinator abundance was medium-high in plot WS2 and medium-low in plots WS3 and WS1. These differences are likely due to the types of flowering plant species present and the amount of flowers they produced, as well as insect populations in the surrounding areas. In the following sections, the same method is used to assess pollinator abundance and species richness within insect groups (Bees/Wasps, Butterflies/Moths, Beetles, and Flies) for each plot.

Hymenoptera (Bees & Wasps)

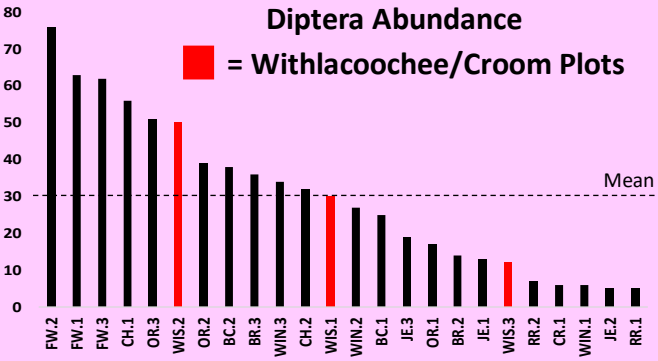
	Abundance # of individuals		Species Richness	
	Total	Rank	Total	Rank
Plot **WS1**	55	Med-Low	34	Med-High
Plot **WS2**	109	Med-High	35	Med-High
Plot **WS3**	83	Med-Low	29	Med-Low
Study Average	98.1		33.6	
Study Range	28 - 266		12 - 61	



Bee and wasp abundance and species richness were moderate in plot WS2 and low in plot WS3. Plot WS1 also had moderate bee and wasp species richness, but low abundance. Some of the most abundant bee and wasp species on the Croom tract were Augochlorella gratiosa (a Green Sweat Bee), Myzinum maculatum (a Flower Wasp), Perdita blatchleyi (a Fairy Bee), Augochloropsis metallica (Northeastern sweat bee), and Lasioglossum apopkense (a Sweat Bee). *Credits for non-FWRI photos on last page.

Diptera (Flies)

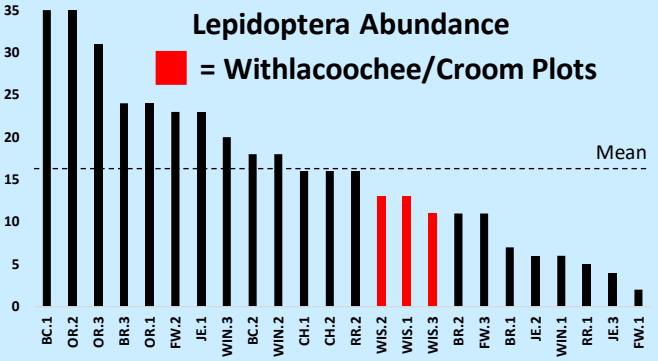
	Abundance # of individuals		Species Richness	
	Total	Rank	Total	Rank
Plot **WS1**	30	Med-Low	13	High
Plot **WS2**	50	High	11	Med-High
Plot **WS3**	12	Med-Low	5	Med-Low
Study Average	30.1		7.6	
Study Range	5 - 79		2 - 18	



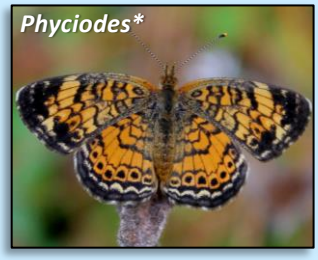
Fly species richness and abundance were moderate to high in all of the Croom Tract plots. Among the most abundant fly species were Exoprosopa fasciata (Banded Bee Fly) Poeciliognathus sulphureus (Sulphurous Bee Fly) Geron sp.(A Bee Fly) Ocyptamus fuscipennis (a Hover Fly), and Palpada vinetorum (a Hover Fly). *Credits for non-FWRI photos on last page.

Lepidoptera (Butterflies & Moths)

	Abundance # of individuals		Species Richness	
	Total	Rank	Total	Rank
Plot **WS1**	13	Med-Low	5	Med-Low
Plot **WS2**	13	Med-Low	9	Med-High
Plot **WS3**	11	Med-Low	5	Med-Low
Study Average	16.2		8.1	
Study Range	2 - 35		2 - 14	

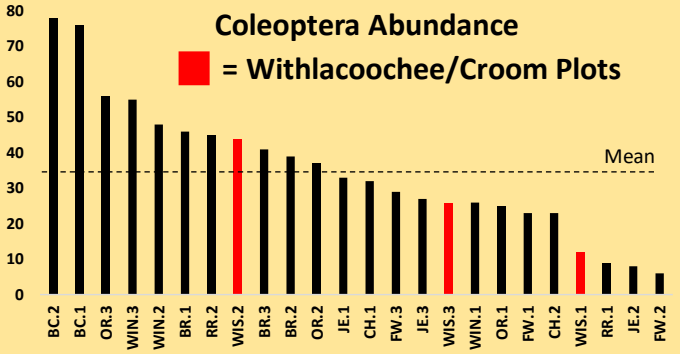


Butterfly & moth abundance was medium-low in all three of the Croom Tract plots. Butterfly & moth species richness was also medium-low in WS1 and WS3, but was medium-high in plot WS2. Among the most abundant Lepidopteran species on the Croom tract were *Phyciodes tharos* (Pearl Crescent), *Battus philenor* (Pipevine swallowtail), *Urbanus proteus* (Long-Tailed Skipper), *Agaulis vanilla* (Gulf fritillary), and *Hylephila phyleus* (Fiery Skipper). *Credits for non-FWRI photos on last page.



Coleoptera (Beetles)

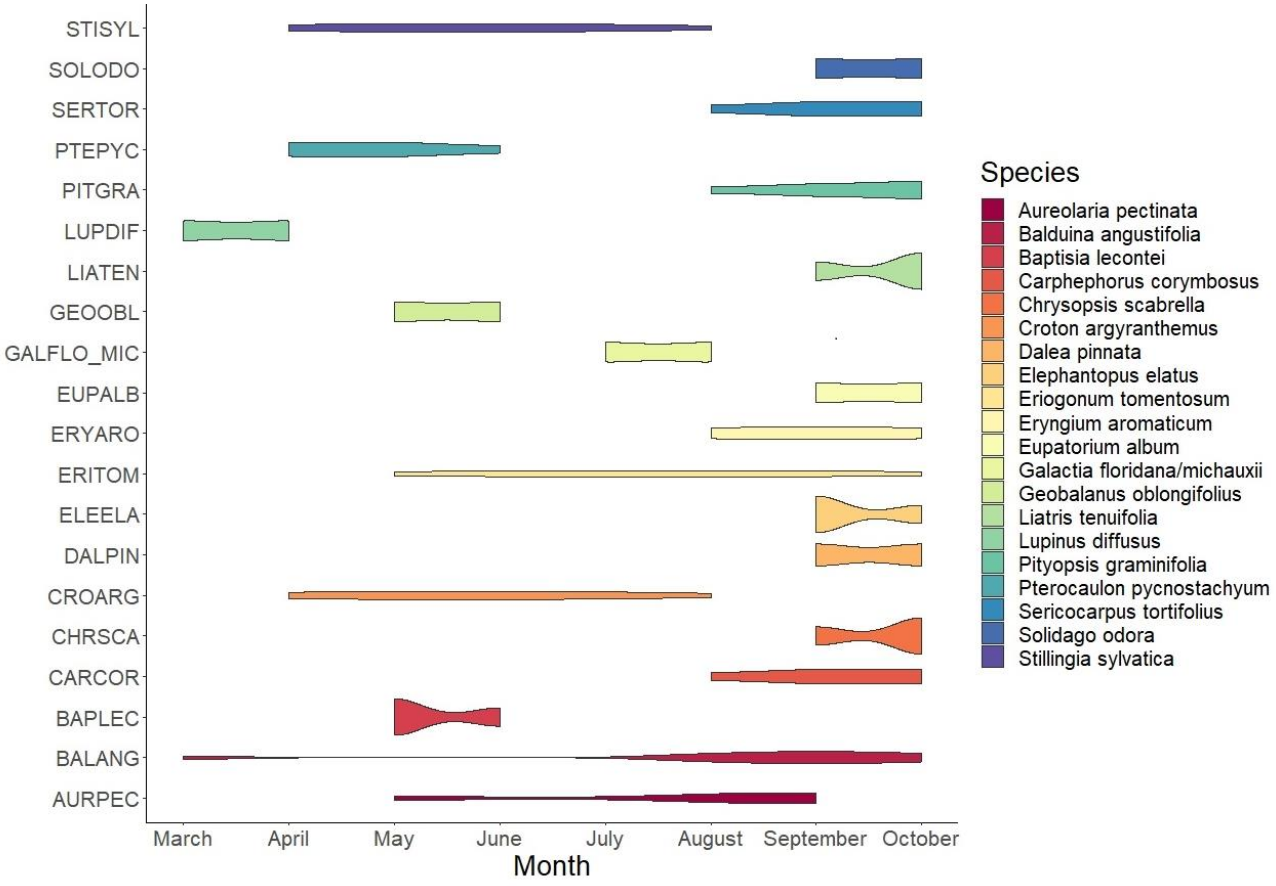
	Abundance # of Individuals		Species Richness	
	Total	Rank	Total	Rank
Plot **WS1**	12	Low	5	Low
Plot **WS2**	44	Med-High	5	Low
Plot **WS3**	26	Med-Low	7	Med-Low
Study Average	35.2		8.0	
Study Range	6 - 78		4 - 14	

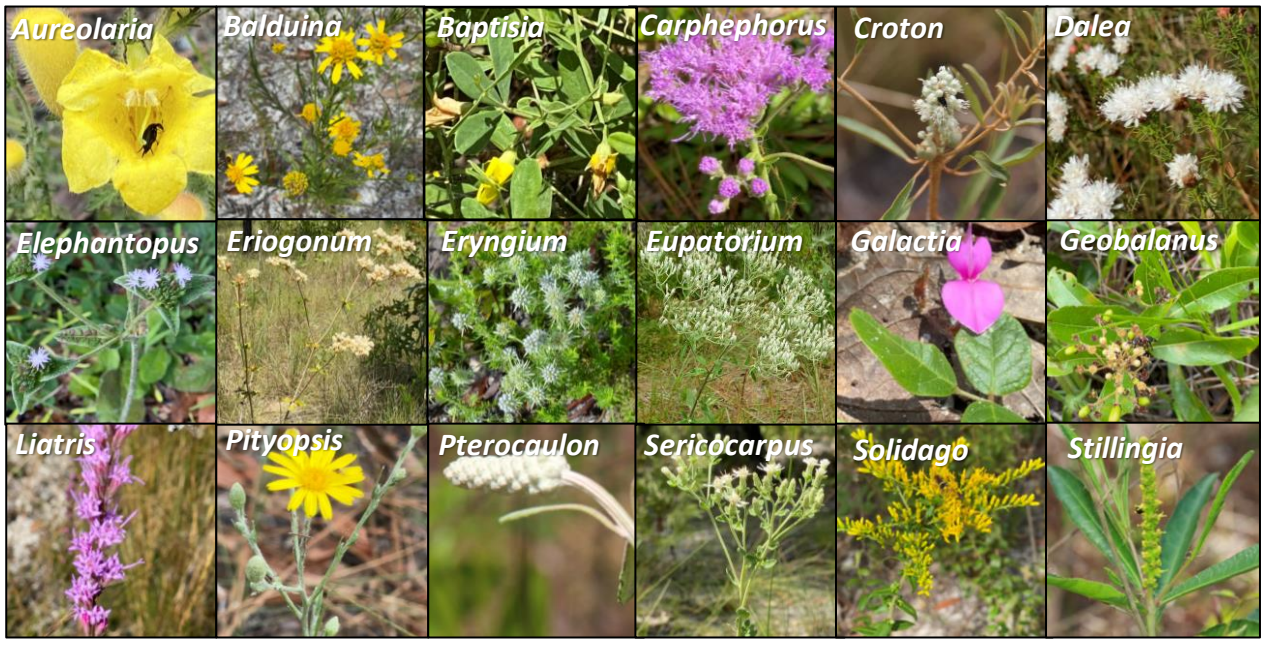


Beetle abundance and species richness were low in plot WS1 and medium-low in plot WS3. Beetle species richness was also low in plot WS2, though beetle abundance in this plot was medium-high. The most abundant beetle species on the Croom Tract were *Epicauta sp.* (Blister beetles), *Trigonopeltastes delta* (Delta Flower Scarab), *Mordellidae sp.* (Tumbling Flower Beetles), *Acmaeodera pulchella* (Bald-Cypress Sapwood Beetle), and *Nemognatha piazata* (a Blister Beetle). *Credits for non-FWRI photos on last page.

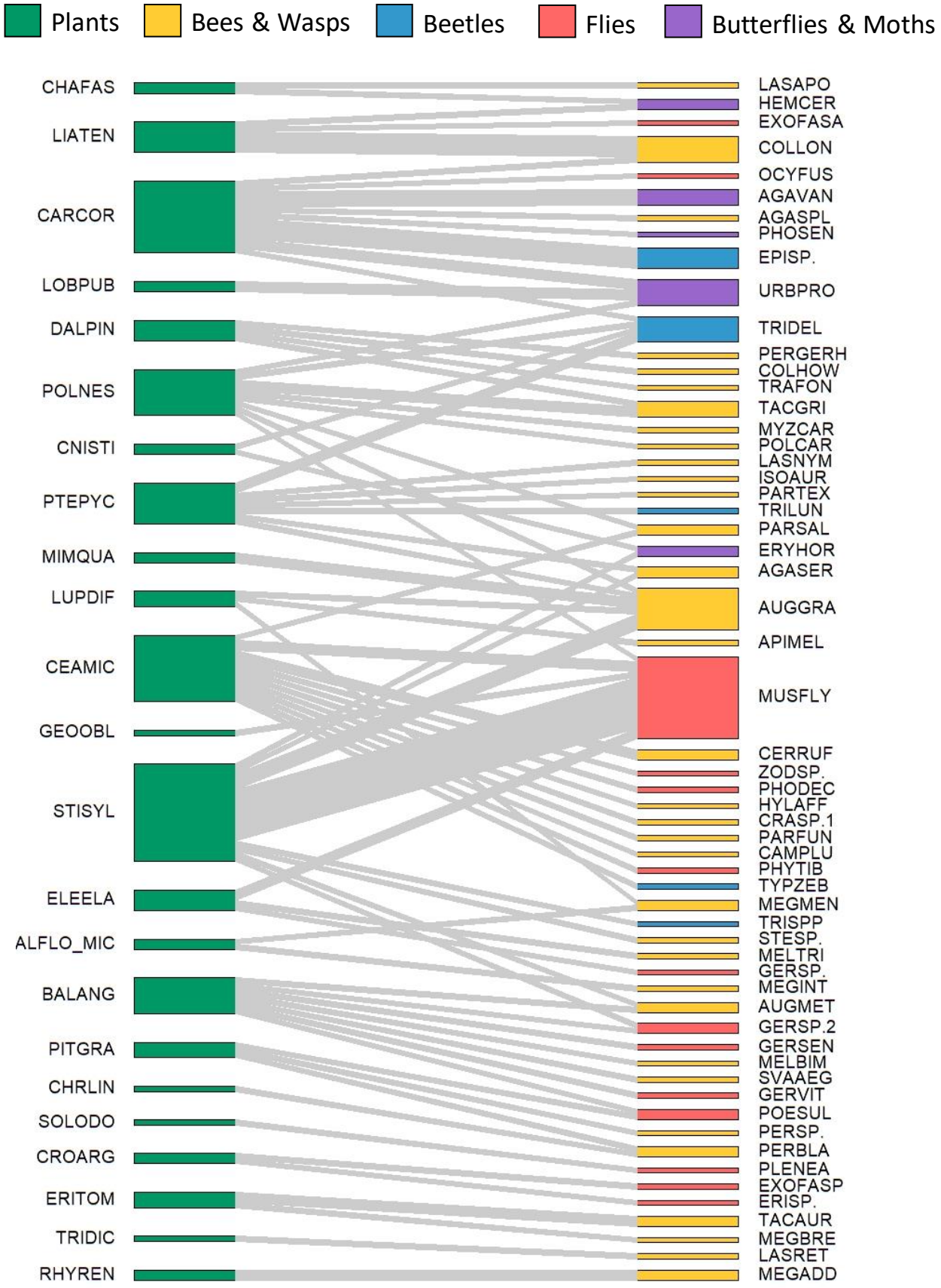
Key flowering plant species

We identified 20 of the most important herbaceous flowering species that were present on multiple sites and had high pollinator interaction rates throughout the study. Many of these species, shown in the graphic below with their blooming time/duration, were present in Withlacoochee - Croom sandhills.

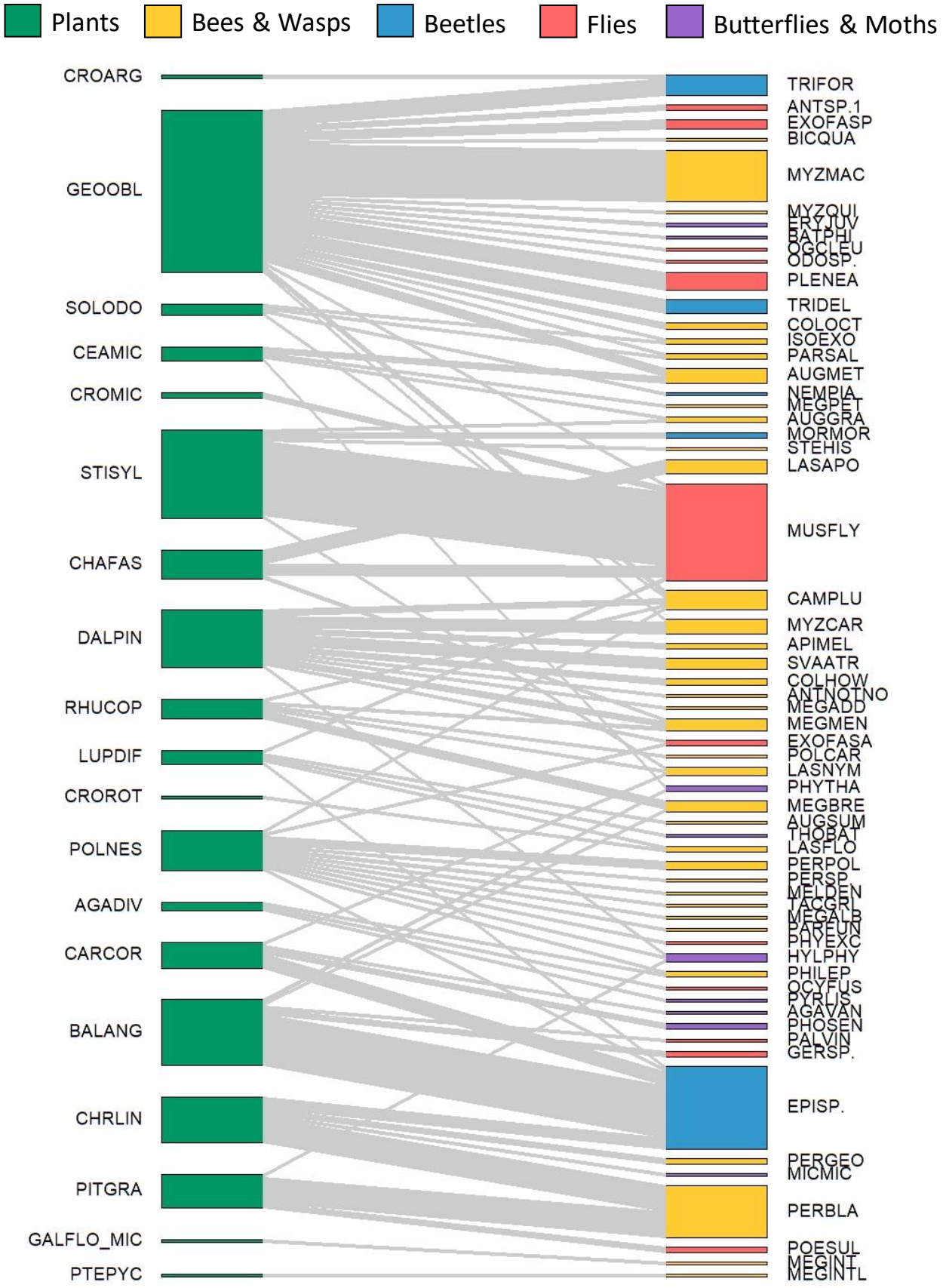




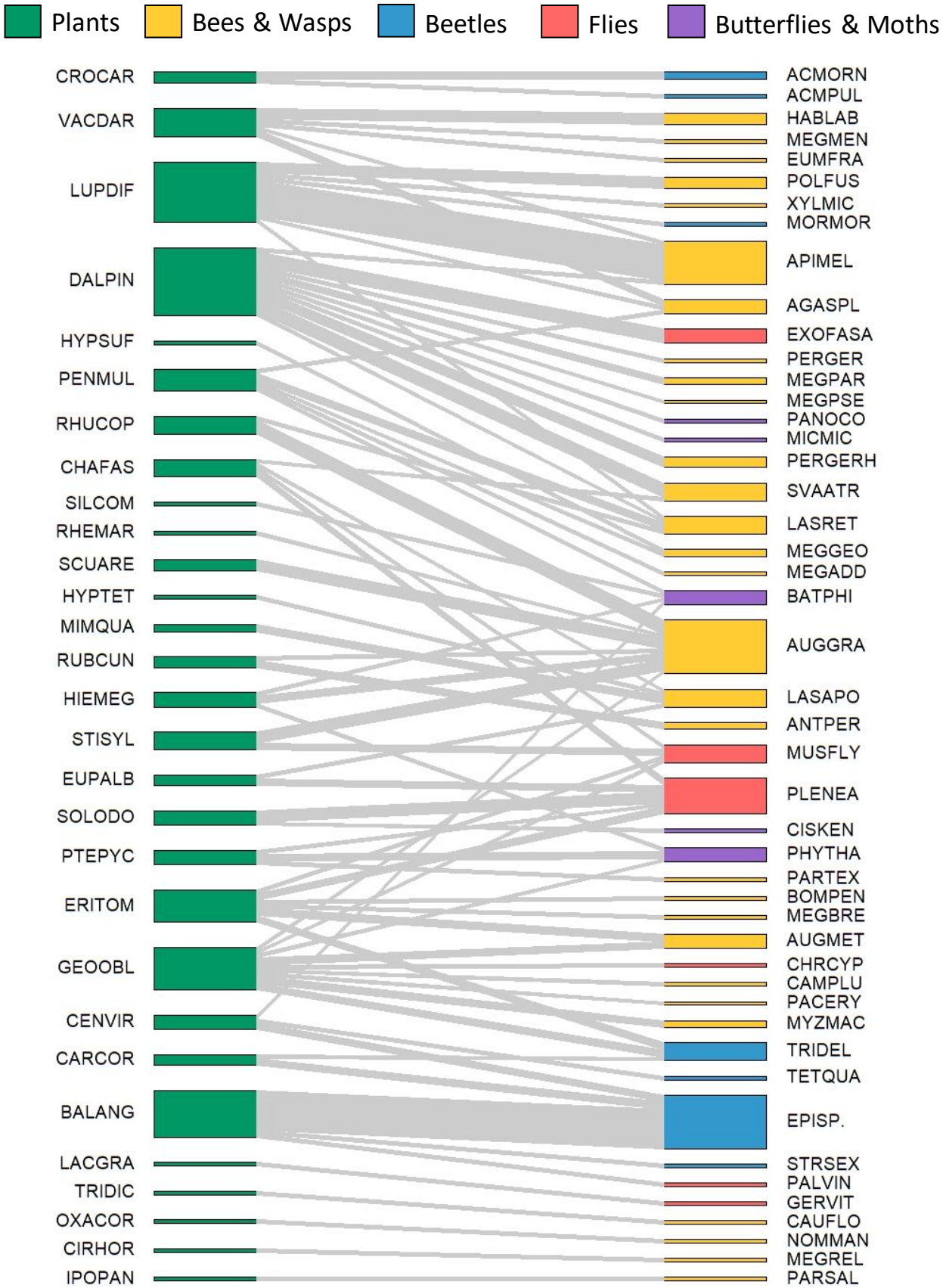
WIS1 Plant-Pollinator Network *Plant and insect code key included at end of report



WIS2 Plant-Pollinator Network *Plant and insect code key included at end of report



WIS3 Plant-Pollinator Network *Plant and insect code key included at end of report



Most abundant pollinator genera at Withlacoochee/Croom

Insect Code Key for network diagrams, with plot occurrence data

		Number Caught			
Code	**Species**	**WN1**	**WN2**	**WN3**	**Insect type**
ACMORN	Acmaeodera ornata	0	0	2	Beetles
ACMPUL	Acmaeodera pulchella	0	0	1	Beetles
AGASER	Agapostemon sericeus	2	0	0	Bees & Wasps
AGASPL	Agapostemon splendens	1	0	4	Bees & Wasps
AGAVAN	Agaulis vanillae	3	1	0	Butterflies & Moths
ANTNOTNOT	Anthidiellum notatum notatum	0	1	0	Bees & Wasps
ANTPER	Anthidiellum perplexum	0	0	2	Bees & Wasps
ANTSP.1	Anthracinae sp. 1	0	2	0	Flies
APIMEL	Apis mellifera	1	2	12	Bees & Wasps
AUGGRA	Augochlorella gratiosa	8	2	16	Bees & Wasps
AUGMET	Augochloropsis metallica	2	5	4	Bees & Wasps
AUGSUM	Augochloropsis sumptuosa	0	1	0	Bees & Wasps
BATPHI	Battus philenor	0	1	4	Butterflies & Moths
BICQUA	Bicyrtes quadrifasciatus	0	1	0	Bees & Wasps
BOMPEN	Bombus pensylvanicus	0	0	1	Bees & Wasps
CAMPLU	Campsomeris plumipes fossula	1	7	1	Bees & Wasps
CAUFLO	Caupolicana floridana	0	0	1	Bees & Wasps
CERRUF	Cerceris rufopicta	2	0	0	Bees & Wasps
CHRCYP	Chrysanthrax cypris	0	0	1	Flies
CISKEN	Cisthene kentuckiensis	0	0	1	Butterflies & Moths
COLHOW	Colletes howardi	1	2	0	Bees & Wasps
COLLON	Colletes longifacies	5	0	0	Bees & Wasps
COLOCT	Colpa octomaculata	0	2	0	Bees & Wasps
CRASP.1	Crabronidae sp. 1	1	0	0	Bees & Wasps
EPISP.	Epicauta sp.	4	29	15	Beetles
ERISP.	Eristalis sp.	1	0	0	Flies
ERYHOR	Erynnis horatius	2	0	0	Butterflies & Moths
ERYJUV	Erynnis juvenalis	0	1	0	Butterflies & Moths
EUMFRA	Eumenes fraternus	0	0	1	Bees & Wasps
EXOFASA	Exoprosopa fasciata	1	2	4	Flies
EXOFASP	Exoprosopa fascipennis	1	3	0	Flies
GERSEN	Geron senilis	1	0	0	Flies
GERSP.	Geron sp.	1	2	0	Flies
GERSP.2	Geron sp. 2	2	0	0	Flies
GERVIT	Geron vitripennis	1	0	1	Flies
HABLAB	Habropoda laboriosa	0	0	3	Bees & Wasps
HEMCER	Hemiargus ceraunus	2	0	0	Butterflies & Moths
HYLAFF	Hylaeus affinis	1	0	0	Bees & Wasps
HYLPHY	Hylephila phyleus	0	3	0	Butterflies & Moths
ISOAUR	Isodontia auripes	1	0	0	Bees & Wasps
ISOEXO	Isodontia exornata	0	2	0	Bees & Wasps
LASAPO	Lasioglossum apopkense	1	5	5	Bees & Wasps

LASFLO	Lasioglossum floridanum	0	2	0	Bees & Wasps
LASNYM	Lasioglossum nymphale	1	3	0	Bees & Wasps
LASRET	Lasioglossum reticulatum	1	0	5	Bees & Wasps
MEGADD	Megachile addenda	2	1	1	Bees & Wasps
MEGALB	Megachile albitarsis	0	1	0	Bees & Wasps
MEGBRE	Megachile brevis	1	4	1	Bees & Wasps
MEGGEO	Megachile georgica	0	0	2	Bees & Wasps
MEGINT	Megachile integra	1	1	0	Bees & Wasps
MEGINTL	Megachile integrella	0	1	0	Bees & Wasps
MEGMEN	Megachile mendica	2	4	1	Bees & Wasps
MEGPAR	Megachile parallela	0	0	2	Bees & Wasps
MEGPET	Megachile petulans	0	1	0	Bees & Wasps
MEGPSE	Megachile pseudobrevis	0	0	1	Bees & Wasps
MEGREL	Megachile relativa	0	0	1	Bees & Wasps
MELBIM	Melissodes bimaculata	1	0	0	Bees & Wasps
MELDEN	Melissodes denticulatus	0	1	0	Bees & Wasps
MELTRI	Melissodes trinodis	1	0	0	Bees & Wasps
MICMIC	microlep	0	1	1	Butterflies & Moths
MORMOR	Mordellidae	0	2	1	Beetles
MUSFLY	muscoid fly	16	34	5	Flies
MYZCAR	Myzinum carolinianum	1	5	0	Bees & Wasps
MYZMAC	Myzinum maculatum	0	18	2	Bees & Wasps
MYZQUI	Myzinum quinquecinctum	0	1	0	Bees & Wasps
NEMPIA	Nemognatha piazata	0	1	0	Beetles
NOMMAN	Nomia maneei	0	0	1	Bees & Wasps
OCYFUS	Ocyptamus fuscipennis	1	1	0	Flies
ODOSP.	Odontomyia sp.	0	1	0	Flies
OGCLEU	Ogcodocera leucoprocta	0	1	0	Flies
PACERY	Pachodynerus erynnis	0	0	1	Bees & Wasps
PALVIN	Palpada vinetorum	0	1	1	Flies
PANOCO	Panoquina ocola	0	0	1	Butterflies & Moths
PARFUN	Paracyphononyx funereus	1	1	0	Bees & Wasps
PARSAL	Parancistrocerus salcularis	2	2	1	Bees & Wasps
PARTEX	Paratiphia texana	1	0	1	Bees & Wasps
PERBLA	Perdita blatchleyi	2	18	0	Bees & Wasps
PERGEO	Perdita georgica	0	2	0	Bees & Wasps
PERGER	Perdita gerardiae	0	0	1	Bees & Wasps
PERGERH	Perdita gerhardi	1	0	3	Bees & Wasps
PERPOL	Perdita polygonellae	0	3	0	Bees & Wasps
PERSP.	Perdita sp.	1	1	0	Bees & Wasps
PHILEP	Philanthus lepidus	0	2	0	Bees & Wasps
PHODEC	Pholeomyia decorior	1	0	0	Flies
PHOSEN	Phoebis sennae	1	2	0	Butterflies & Moths
PHYEXC	Physoconops excisus	0	1	0	Flies
PHYTHA	Phyciodes tharos	0	2	4	Butterflies & Moths
PHYTIB	Physocephala tibialis	1	0	0	Flies

PLENEA	Plecia nearctica	1	6	10	Flies
POESUL	Poeciliognathus sulphureus	2	2	0	Flies
POLCAR	Polistes carolina	1	1	0	Bees & Wasps
POLFUS	Polistes fuscatus	0	0	3	Bees & Wasps
PYRLIS	Pyrisitia lisa	0	1	0	Butterflies & Moths
STEHIS	Stenodynerus histrionalis	0	1	0	Bees & Wasps
STESP.	Stenodynerus sp.	1	0	0	Bees & Wasps
STRSEX	Stranglia sexnotata	0	0	1	Beetles
SVAAEG	Svastra aegis	1	0	0	Bees & Wasps
SVAATR	Svastra atripes	0	4	5	Bees & Wasps
TACAUR	Tachytes auricomans	2	0	0	Bees & Wasps
TACGRI	Tachytes grisselli	3	1	0	Bees & Wasps
TETQUA	Tetraonyx quadrimaculata	0	0	1	Beetles
THOBAT	Thorybes bathyllus	0	1	0	Butterflies & Moths
TRAFON	Trachusa fontemvitae	1	0	0	Bees & Wasps
TRIDEL	Trigonopeltastes delta	5	5	5	Beetles
TRIFOR	Trigonopeltastes foridana	0	7	0	Beetles
TRILUN	Trichiotinus lunulatus	1	0	0	Beetles
TRISPP	Trichiotinus spp.	1	0	0	Beetles
TYPZEB	Typocerus zebra	1	0	0	Beetles
URBPRO	Urbanus proteus	5	0	0	Butterflies & Moths
XYLMIC	Xylocopa micans	0	0	1	Bees & Wasps
ZODSP.	Zodion sp.	1	0	0	Flies

Plant Code Key for network diagrams, with plot occurrence data

		Relative Frequency			
		(% of quads in which present)			
Code	**Species**	**WS1**	**WS2**	**WS3**	**Plant Type**
AESVIS	Aeschynomene viscidula	0	0	1	Forb
AGAPLU	Agalinis plukenettii	3	4	0	Forb
AGEJUC	Ageratina jucunda	33	1	13	Forb
ASCVER	Asclepias verticillata	3	5	7	Forb
ASEVIO	Asemia violacea	5	0	1	Forb
ASIINC	Asimina incana	3	5	7	Shrub
ASIRET	Asimina reticulata	0	0	21	Shrub
BALANG	Balduina angustifolia	23	25	4	Forb
BIDALB	Bidens alba	0	0	7	Forb
CARCOR	Carphephorus corymbosus	56	46	10	Forb
CEAMIC	Ceanothus microphyllus	2	0	4	Forb
CENVIR	Centrosema virginianum	32	3	30	Forb
CHAFAS	Chamaecrista fasciculata	16	33	7	Forb
CHANIC	Chamaecrista nictitans	14	0	28	Forb
CHRLAT	Chrysopsis latisquamea	0	0	3	Forb
CHRLIN	Chrysopsis linearifolia	4	11	6	Forb
CIRHOR	Cirsium horridulum	2	0	1	Forb
CNISTI	Cnidoscolus stimulosus	6	16	14	Forb
COMERE	Commelina erecta	1	0	2	Forb
CONCAN	Conyza canadensis	1	0	0	Forb
CROARG	Croton argyranthemus	26	24	18	Forb
CROCAR	Crocantheumum carolinian	3	0	1	Forb
CROCOR	Crocantheumum corymbos	12	5	16	Forb
CRODIV	Croptilon divaricatum	0	0	1	Forb
CROMIC	Croton michauxii	1	12	16	Forb
CROROT	Crotalaria rotundifolia	42	16	15	Forb
DALPIN	Dalea pinnata	18	22	46	Forb
DIOSVI	Diospyros virginiana	6	8	2	Shrub
ELEELA	Elephantopus elatus	33	9	34	Forb
ERITOM	Eriogonum tomentosum	30	30	9	Forb
EUPALB	Eupatorium album	2	0	13	Forb
EUPCOM	Eupatorium compositifoliun	17	5	7	Forb
GALFLO_M	Galactia floridana/michauxi	16	59	40	Forb
GEOOBL	Geobalanus oblongifolius	10	41	36	Forb
HIEMEG	Hieracium megacephalon	20	14	24	Forb
HYPSUF	Hypericum suffruticosum	2	0	5	Shrub
HYPTET	Hypericum tetrapetalum	2	0	5	Shrub

IPOPAN	Ipomoea pandurata	0	0	4	Forb
LACGRA	Lactuca graminifolia	2	1	8	Forb
LESHIR	Lespedeza hirta	15	3	24	Forb
LIATEN	Liatris tenuifolia	21	8	20	Forb
LUPDIF	Lupinus diffusus	1	1	1	Forb
LYGAPH	Lygodesmia aphylla	0	0	1	Forb
OPUHUM	Opuntia humifusa	0	1	1	Forb
OXACOR	Oxalis corniculata	0	0	17	Forb
PALINT	Palafoxia integrifolia	7	2	1	Forb
PIRCIS	Piriqueta cistoides	1	11	3	Forb
PITGRA	Pityopsis graminifolia	45	92	32	Forb
POLNES	Polygonum nesomii	3	9	4	Forb
POLPIN	Polygonum pinicola	25	87	24	Forb
PTEPYC	Pterocaulon pycnostachyum	11	15	15	Forb
RHEMAR	Rhexia mariana	0	0	3	Forb
RHUCOP	Rhus copallinum	60	86	78	Shrub
RHYREN	Rhynchosia reniformis	24	7	27	Forb
RUBCUN	Rubus cuneifolius	14	1	63	Shrub
RUECAR	Ruellia caroliniensis	15	23	16	Forb
SCUARE	Scutellaria arenicola	17	17	5	Forb
SERREP	Serenoa repens	4	0	11	Shrub
SERTOR	Sericocarpus tortifolius	14	0	1	Forb
SILCOM	Silphium compositum	0	0	2	Forb
SMIAUR	Smilax auriculata	20	5	53	Shrub
SOLLEA	Solidago leavenworthii	4	0	0	Forb
SOLODO	Solidago odora	0	3	27	Forb
STISYL	Stillingia sylvatica	23	45	19	Forb
STYBIF	Stylosanthes biflora	11	3	3	Forb
STYPAT	Stylisma patens	11	7	2	Forb
SYMCON	Symphyotrichum concolor	0	0	19	Forb
TEPCHR_S	Tephrosia chrysophylla/spic	25	46	9	Forb
TEPFLO	Tephrosia florida	2	2	24	Forb
TRIDIC	Trichostema dichotomum	17	3	11	Forb
VACARB	Vaccinium arboreum	6	0	14	Shrub
VACMYR	Vaccinium myrsinites	0	0	47	Shrub
VERANG	Vernonia angustifolia	5	0	0	Forb
YUCFIL	Yucca filamentosa	0	0	1	Shrub

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Additional Resources

For more information on the natural history and identification of the insects we found at the Withlachoochee Croom Tract, these are good places to start:

BugGuide.net: https://bugguide.net/node/view/15740

Discover Life: https://www.discoverlife.org/

For more information on the natural history and identification of the pollinator plants at the Withlachoochee Croom Tract, start with these resources:

Flora of North America: http://floranorthamerica.org/Main_Page

Atlas of Florida Vascular Plants: https://florida.plantatlas.usf.edu/

For a more detailed accounting of data analysis, conclusions, and management recommendations, check our FWRI/Upland Habitat website for publications and reports, which will be uploaded as they are finalized: https://myfwc.com/research/habitat/upland/.

Feel free to contact FWRI's Upland Habitat Research & Monitoring team with plant and pollinator questions any time, if we don't have the answer we can find out or point you in the right direction:

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