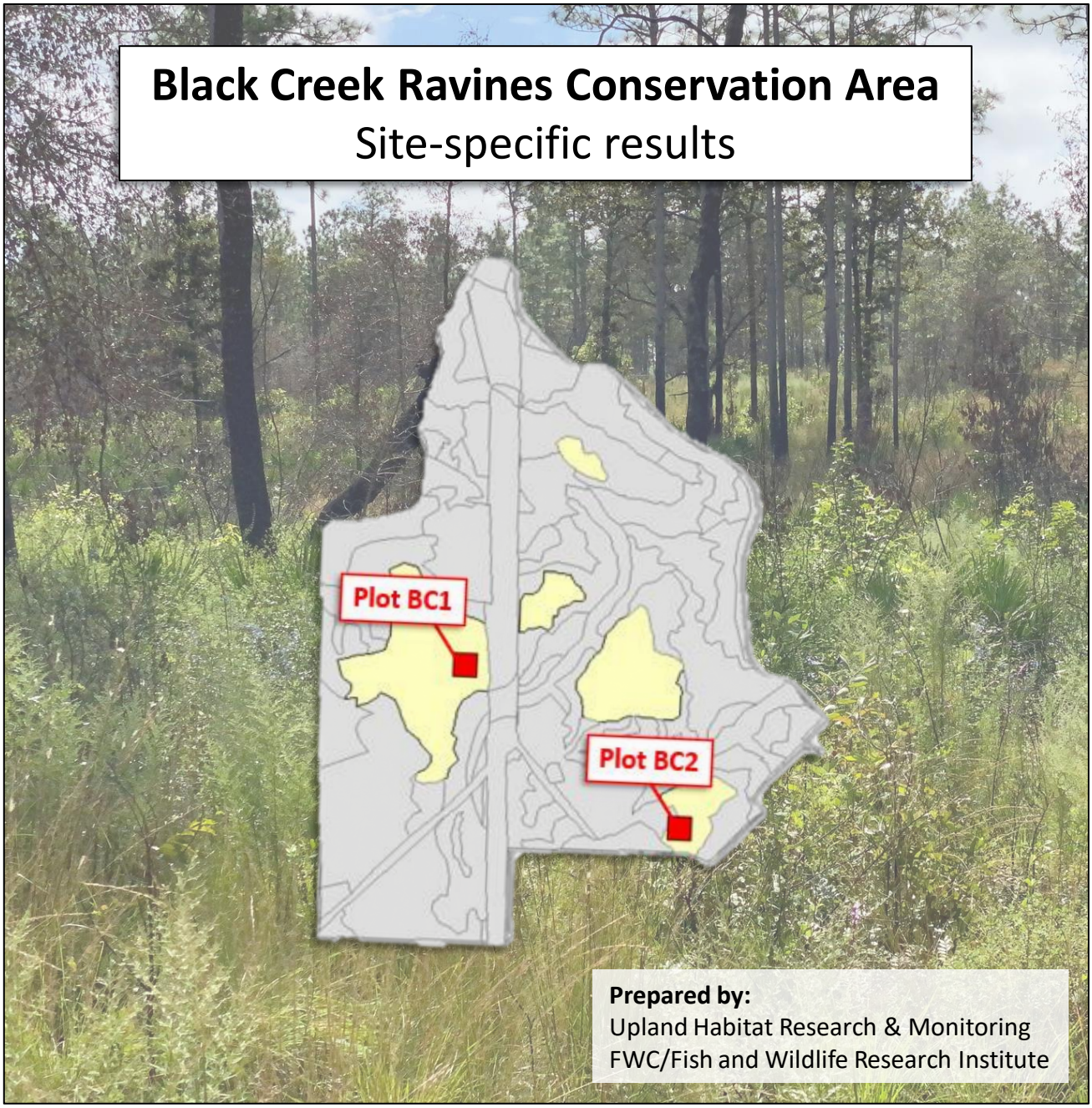
Plant-Pollinator Networks in Fire-Maintained Sandhills

Research Study (2019-2020)

Black Creek Ravines Conservation Area

Site-specific results



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Plant: Solidago odora
Pollinator: Ammophila procera

Introduction

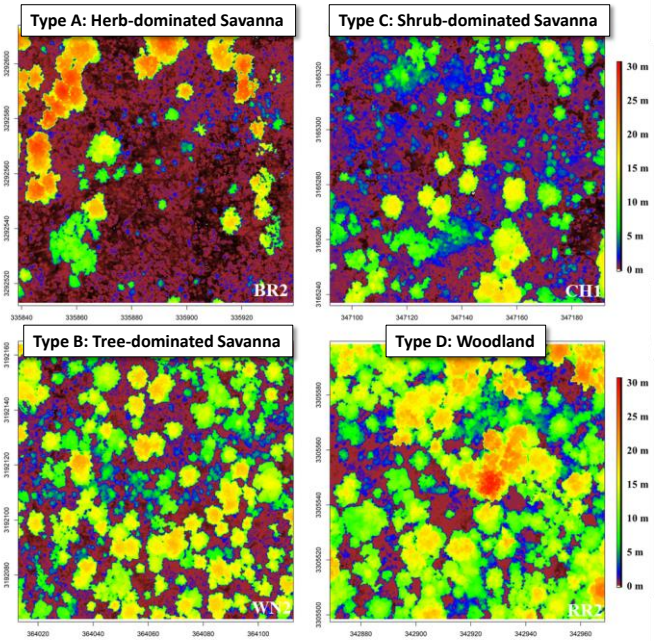
In Florida's fire-dependent longleaf pine savannas, as in terrestrial ecosystems worldwide, the mutualistic interaction networks formed by flowering plants and pollinators are of fundamental importance for the maintenance of biodiversity (Bascompte and Jordano 2007). Florida is part of the North American 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.

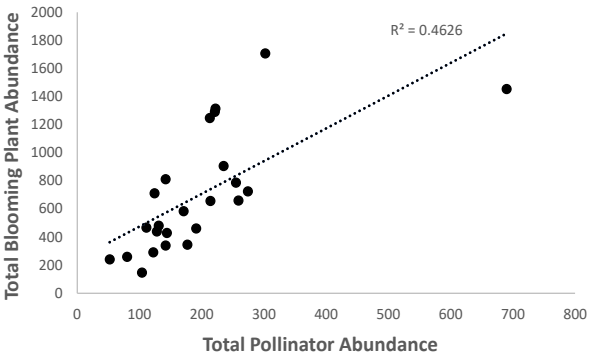


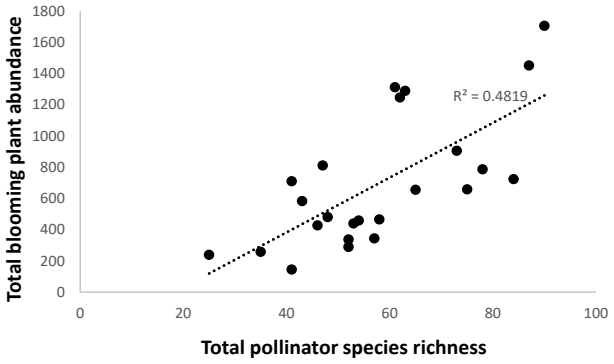
Overall Study Results: Vegetation Structure

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.



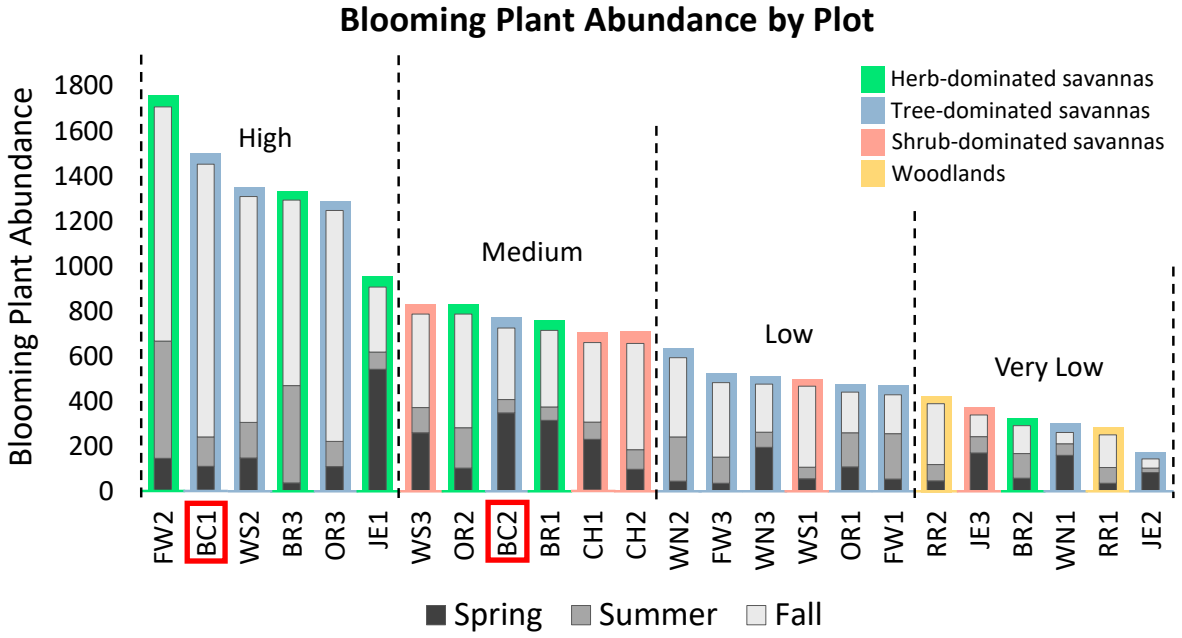


Overall Study Results: Flower and Pollinator Abundance cont'd

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/.

Black Creek Flower Abundance Results

Both of the Black Creek study plots were in our "tree-dominated savanna" category, but also contained abundant herbaceous cover. Plot BC1 was in the High blooming plant abundance quantile, having the second-highest blooming plant abundance in the whole study. Plot BC2 was in the Medium blooming plant abundance quantile, and had an above-average abundance of spring-blooming shrubs (primarily saw palmetto, blueberries, and huckleberries). Plot BC1 had a very high abundance of fall-blooming pollinator plants, primarily *Galactia* (milkpeas), *Palafoxia integrifolia* (Coastalplain palafox), and *Carphephorus corymbosus (*Coastalplain chaffhead). The results of our overall study suggest that the abundance of pollinator-attracting wildflowers at Black Creek is likely due in part to canopy openness associated with frequent prescribed fire, which has often been applied during the growing season at this site.

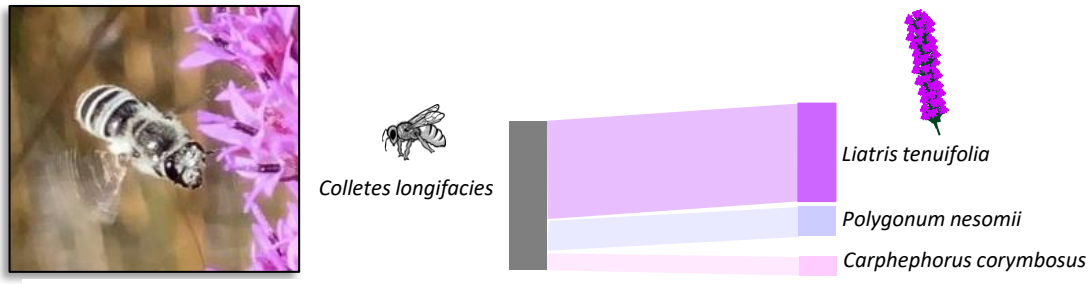


Black Creek Results: Pollinator Overview

Overall pollinator abundance and species richness were high in both plots at Black Creek. Within the major pollinating insect groups, Hymenoptera (Bees & Wasps), Lepidoptera (Butterflies & Moths), and Coleoptera (Beetles) all had generally high abundance and species richness across both plots. The only insect group with low to moderate abundance and species richness was Diptera (flies). Our overall study results suggest that the high level of pollinator abundance and species richness at Black Creek is related to high flower abundance. It should be noted that Plot BC1 at Black Creek was the only plot in the study that had a growing-season burn in the year prior to sampling, and this burn timing may have been partially responsible for the very high abundance of flowers and pollinators in BC1.

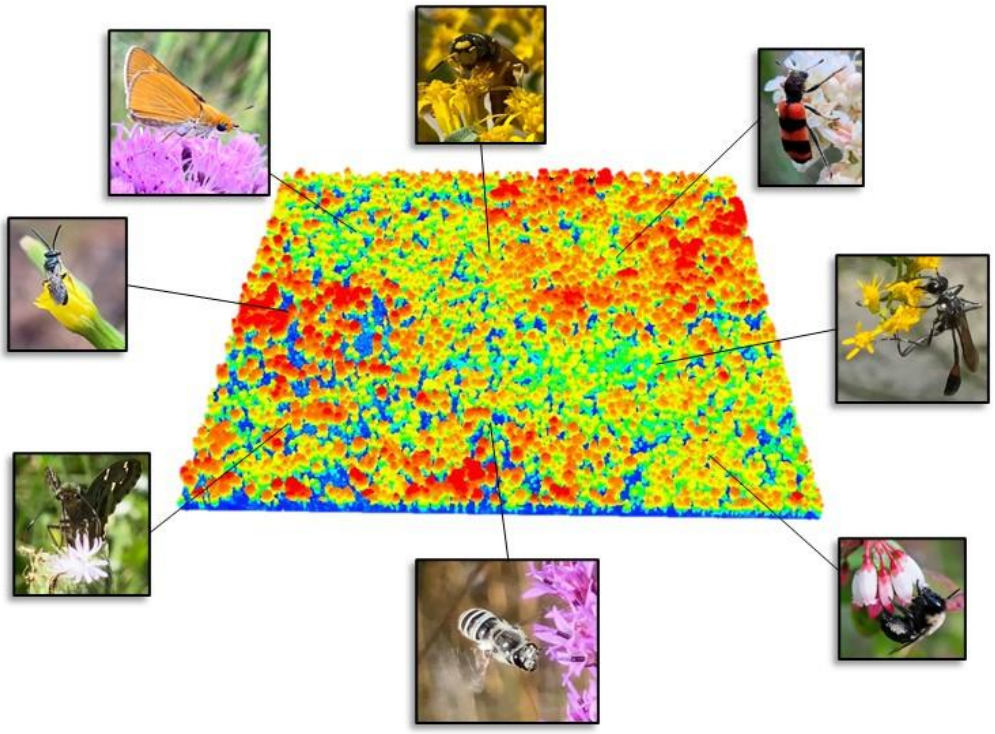
Species of Greatest Conservation Need

Colletes longifacies, a Species of Greatest Conservation Need identified by Florida's State Wildlife Action Plan, was collected in **Plot BC1,** and *Bombus pensylvanicus* (another SGCN species), was collected in lower abundance in **Plot BC2.** We recorded enough observations of *C. longifacies* in the overall study to draw conclusions about flower preferences and make preliminary management recommendations. *C. longifacies* does not appear to be a specialist, as we observed it interacting primarily with the unrelated genera *Liatris tenuifolia* and *Polygonum nesomii*. Promoting flowering in these two plant genera, along with the third genus upon which the bee was caught, *Carphephorus corymbosus,* may be a good conservation target for improving *C. longifacies* habitat. *L. tenuifolia* is sensitive to vegetation structure and becomes 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 this SGCN bee.



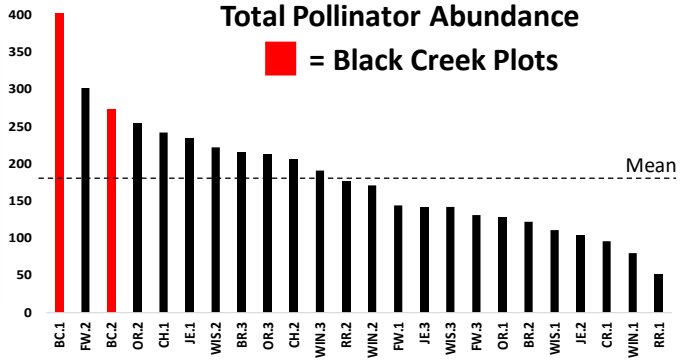
Flower interactions of *Colletes longifacies*, based on 24 observations recorded during the project.

Black Creek Results
Pollinator Abundance and Species Richness



Overall Pollinator Abundance & Species Richness

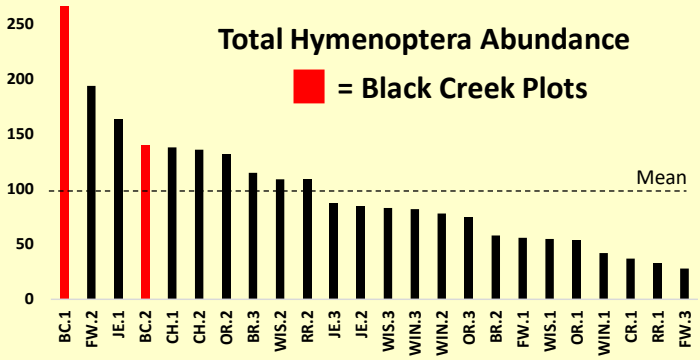
	Abundance # of individuals		Species Richness	
	Total	Rank	Total	Rank
Plot BC1	**402**	High	**87**	High
Plot BC2	**274**	High	**84**	High
Study Average	181.6		57.6	
Study Range	52 - 402		25 - 90	



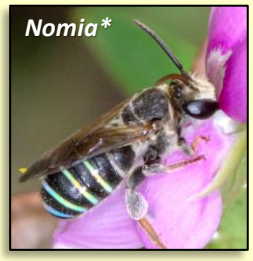
The above table shows the total pollinator abundance (number of individual insects caught) and total pollinator species richness for the three study plots at Black Creek, along with their rank relative to the entire 24-plot study. Plots within one Standard Deviation (SD) above the mean were ranked "**Medium-High**," 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**." Both plots **BC1** and **BC2** had very high pollinator species richness and abundance relative to the rest of the plots in the study. 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).

Hymenoptera (Bees & Wasps)

	Abundance # of individuals		Species Richness	
	Total	Rank	Total	Rank
Plot **BC1**	266	High	49	High
Plot **BC2**	139	Med-High	55	High
Study Average	98.2		33.6	
Study Range	28 - 266		12 - 61	

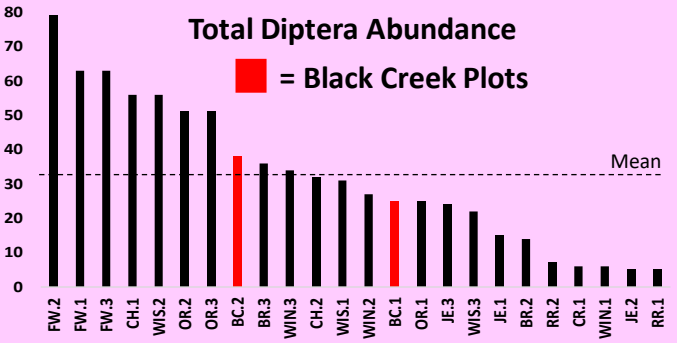


Bee & wasp abundance and species richness were very high in both BC1 and BC2. Among the most abundant species were *Augochlorella gratiosa* (a green sweat bee), *Lasioglossum nymphale* (Orange-tailed metallic sweat bee), *Bombus impatiens* (Common Eastern bumblebee), *Xylocopa virginica* (Eastern carpenter bee), and *Nomia maneei* (Pearly-banded bee). The exotic European Honeybee *(Apis mellifera)* was also prevalent in BC1, but is not included in this summary of native bees. *Photo credits for non-FWRI photos on last page.



Diptera (Flies)

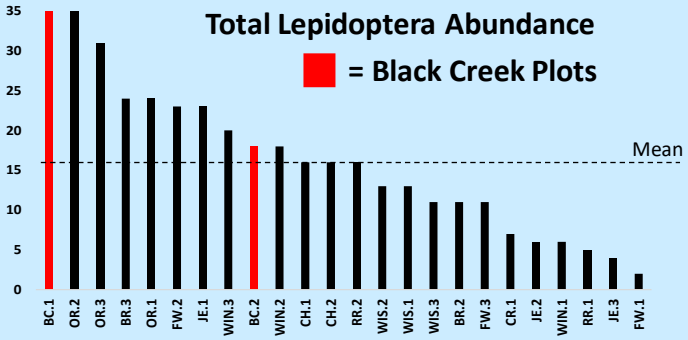
	Abundance # of individuals		Species Richness	
	Total	Rank	Total	Rank
Plot BC1	25	Med-Low	8	Med-High
Plot BC2	38	Med-High	6	Med-Low
Study Average	32.1		8.0	
Study Range	5-79		2-18	



In plot BC1, fly abundance was medium-low, but fly species richness was medium-high. The opposite was true in plot BC2, which had medium-high fly abundance but medium-low species richness. Five of the most abundant fly species at Black Creek were *Poeciliognathus sulphureus* (Sulphurous Bee Fly), *Exoprosopa fascipennis* (Band-Winged Bee Fly), *Geron vitripennis* (Glassy-Winged Bee Fly), *Meromacrus acutus* (Carolinian Elegant), and *Ocyptamus fuscipennis* (Dusky-Winged Hover Fly). *Photo credits for non-FWRI photos on last page.

Lepidoptera (Butterflies & Moths)

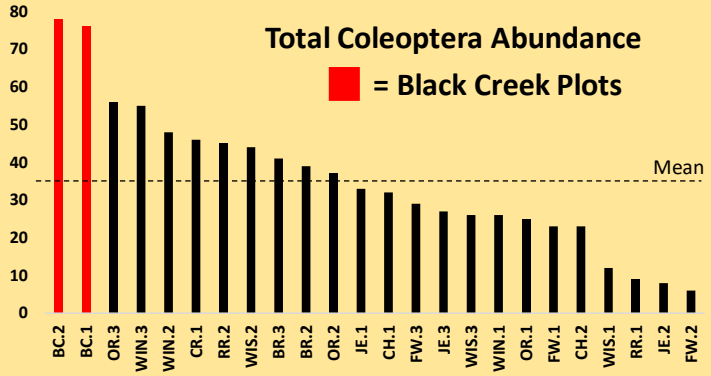
	Abundance (# of individuals)		Species Richness	
	Total	Rank	Total	Rank
Plot **BC1**	35	High	14	High
Plot **BC2**	18	Med-High	12	High
Study Average	16.2		8.1	
Study Range	2-35		2-14	



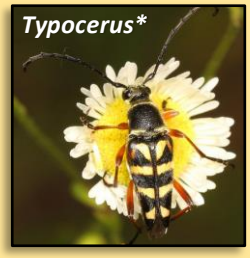
Butterfly & moth abundance was above the study average in plot BC1 and slightly higher than the study average in plots BC2. Butterfly & moth species richness was also above average in Plots BC1 and BC2. *Hemiargus ceraunus* (Ceraunus blue), *Urbanus proteus* (Long-tailed skipper), and *Agaulis vanilla* (Gulf fritillary), *Polites vibex* (Whirlabout), *Panoquina ocola* (Ocola skipper) pictured below, were the three most abundant Lepidopteran species at Black Creek. *Photo credits for non-FWRI photos on last page.

Coleoptera (Beetles)

	Abundance # of Individuals		Species Richness	
	Total	Rank	Total	Rank
Plot **BC1**	76	High	14	High
Plot **BC2**	78	High	10	Med-High
Study Average	35.2		8.0	
Study Range	6-78		4-14	

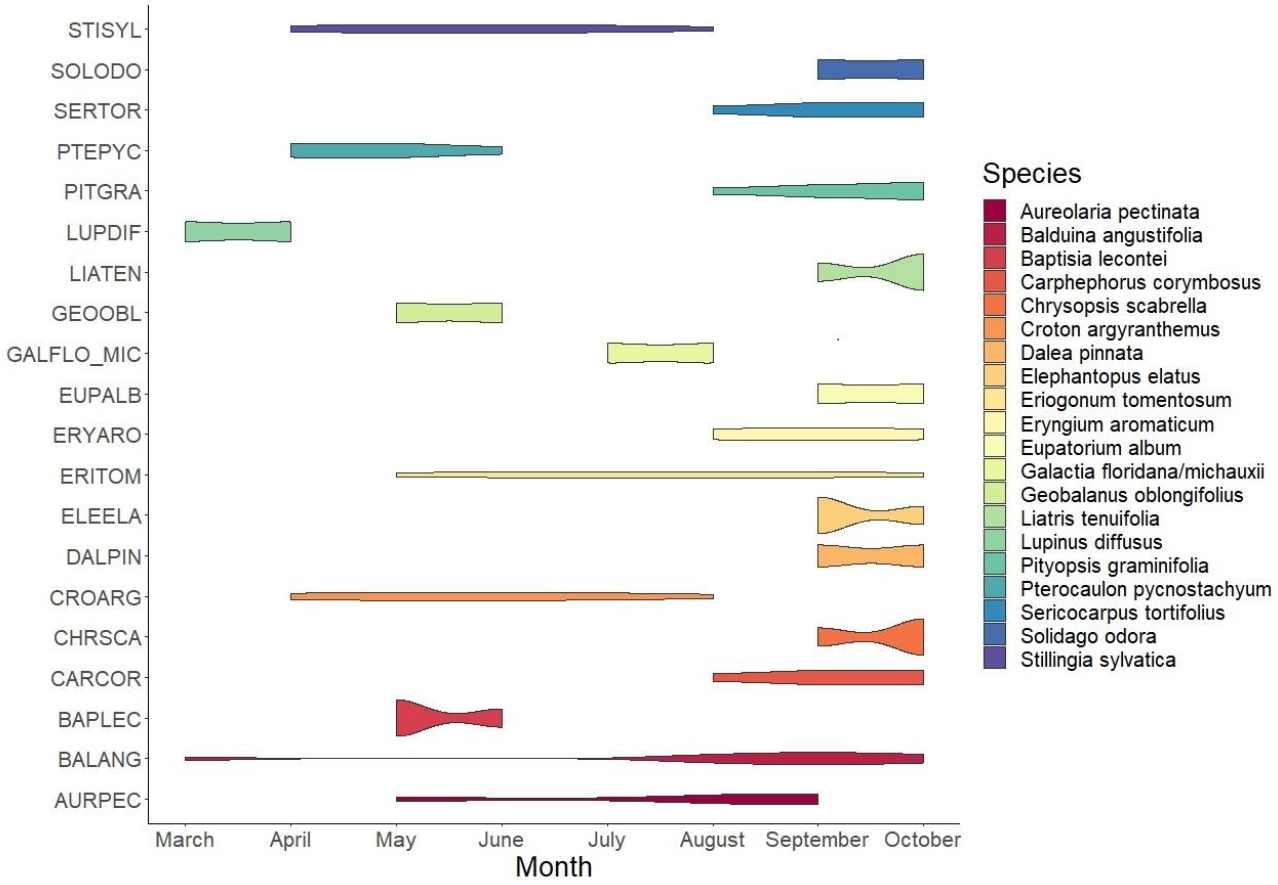


Beetle abundance and species richness were very high in both plots BC1 and BC2. The most abundant beetle pollinators at Black Creek were *Chauliognathus marginatus* (Margined Leatherwing), *Trigonopeltastes delta* (Delta Flower Beetle), *Mordella atrata* (Tumbling Flower Beetle), *Trichiotinus rufobrunneus* (A flower scarab), and *Typocerus zebra* (Zebra Flower Longhorn). *Photo credits for non-FWRI photos on last page.



Key flowering plant species

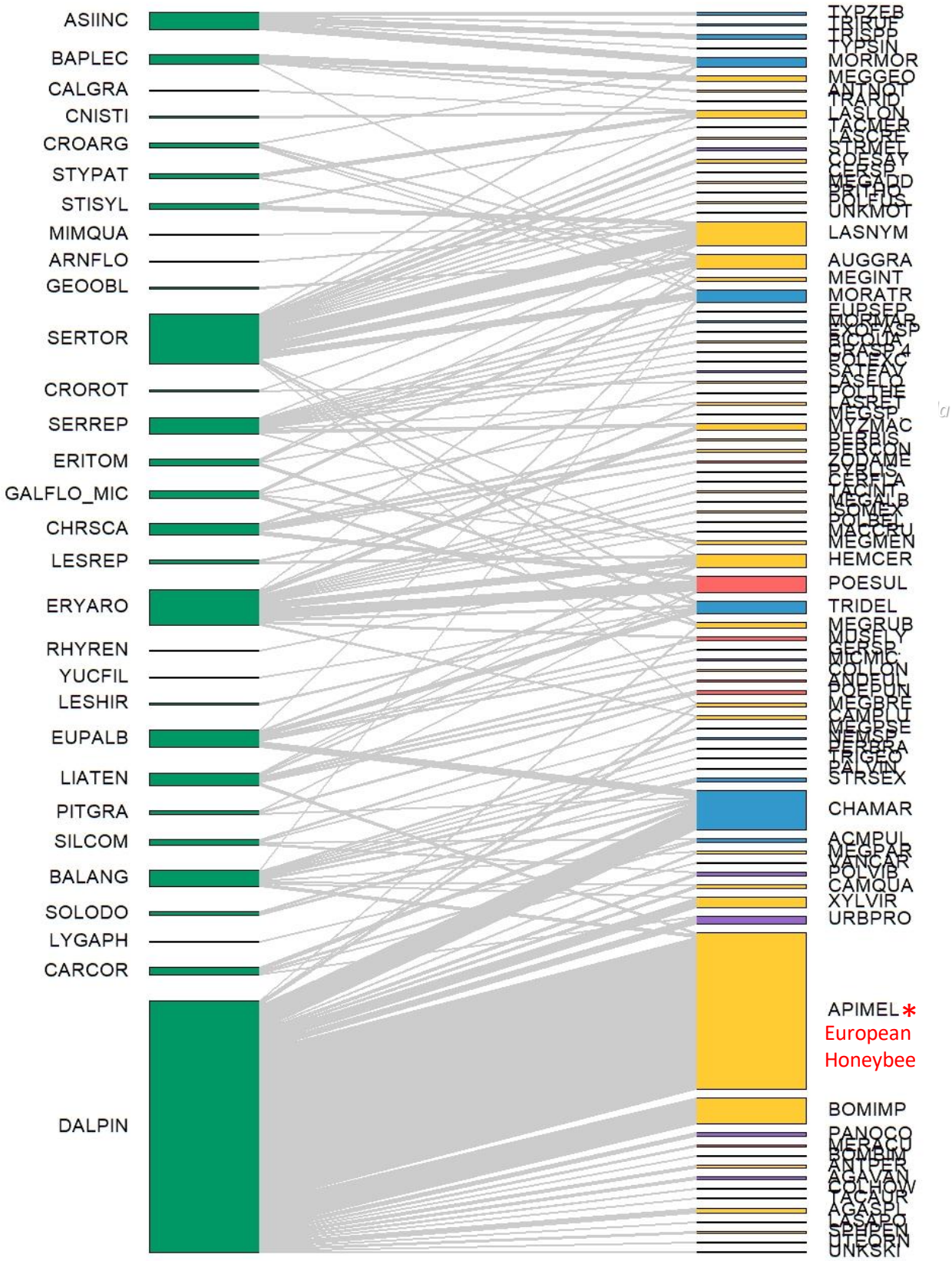
We identified 20 of the most important herbaceous flowering species that were present on multiple sites and had high pollinator interaction rates throughout the study. Many of these species, shown in the graphic below with their blooming time/duration, were prevalent in Black Creek sandhills.



BC1 Plant-Pollinator Network

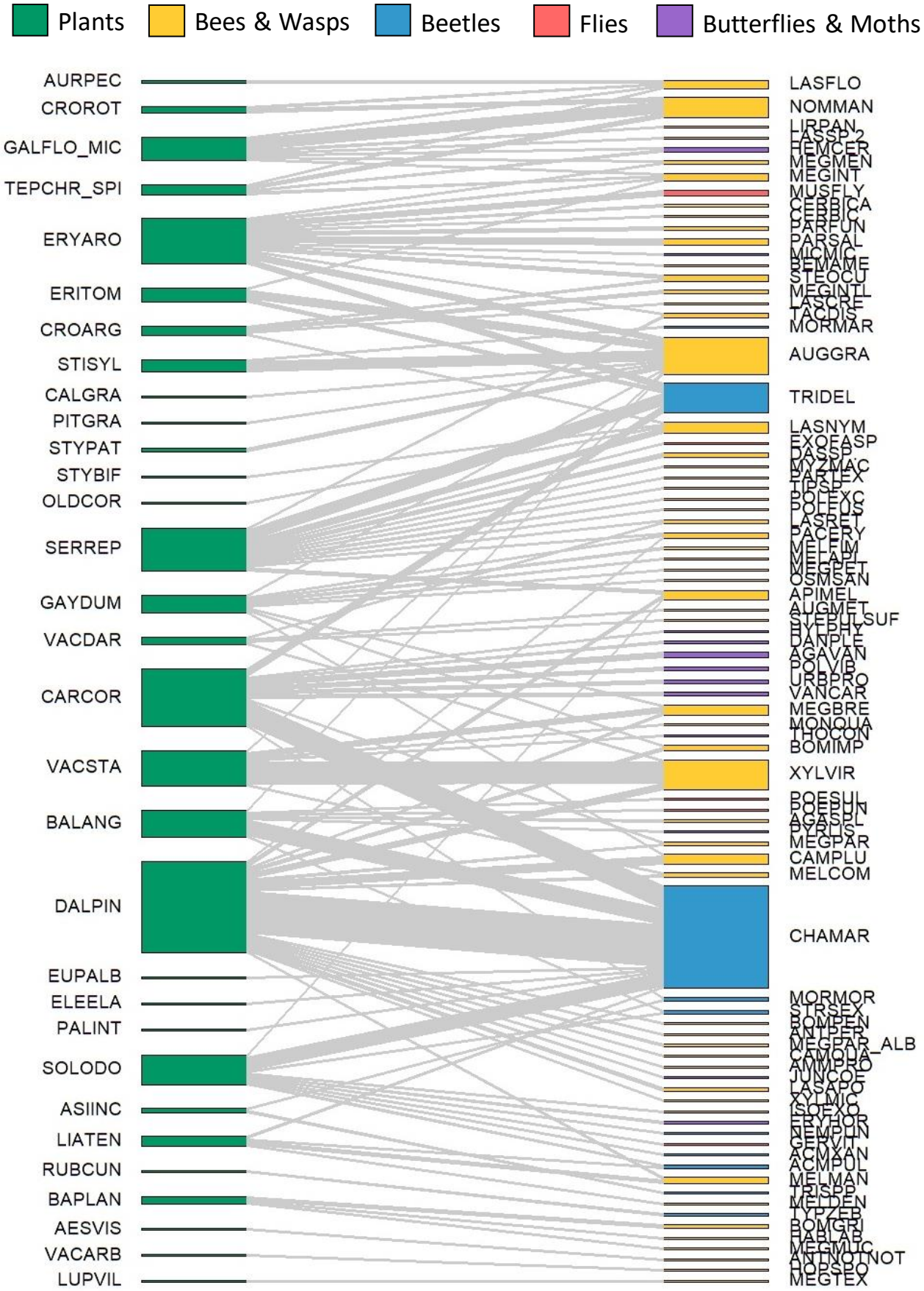
*Plant and insect code key included at end of report

Plants | Bees & Wasps | Beetles | Flies | Butterflies & Moths



BC2 Plant-Pollinator Network

*Plant and insect code key included at end of report



Most frequently observed pollinator genera at Black Creek

Insect Code Key for network diagrams, with plot occurrence data

		Relative Frequency (% of quads)		
Code	**Species**	**BC-1**	**BC-2**	**Insect Type**
ACMPUL	Acmaeodera pulchella	3	2	Beetles
ACMXAN	Acmaeodera xanthosticta	0	1	Beetles
AGASPL	Agapostemon splendens	4	1	Bees & Wasps
AGAVAN	Agaulis vanillae	2	3	Butterflies & Moths
AMMPRO	Ammophila procera	0	1	Bees & Wasps
ANDFUL	Andrena fulvipennis	1	0	Bees & Wasps
ANTNOT	Anthidiellum notatum	1	0	Bees & Wasps
ANTNOTNOT	Anthidiellum notatum notatum	0	1	Bees & Wasps
ANTPER	Anthidiellum perplexum	2	1	Bees & Wasps
APIMEL	Apis mellifera	124	5	Bees & Wasps
AUGGRA	Augochlorella gratiosa	11	19	Bees & Wasps
AUGMET	Augochloropsis metallica	0	1	Bees & Wasps
BEMAME	Bembix americana spinolae	0	1	Bees & Wasps
BICQUA	Bicyrtes quadrifasciatus	1	0	Bees & Wasps
BOMBIM	Bombus bimaculatus	1	0	Bees & Wasps
BOMGRI	Bombus griseocollis	0	2	Bees & Wasps
BOMIMP	Bombus impatiens	21	3	Bees & Wasps
BOMPEN	Bombus pensylvanicus	0	1	Bees & Wasps
CAMPLU	Campsomeris plumipes fossulana	3	5	Bees & Wasps
CAMQUA	Campsomeris quadrimaculata	3	1	Bees & Wasps
CERBIC	Cerceris bicornuta	0	1	Bees & Wasps
CERBICA	Cerceris bicornata	0	1	Bees & Wasps
CERFLA	Cerceris flavofasciata floridensis	1	0	Bees & Wasps
CERSP.	Cerceris sp.	1	0	Bees & Wasps
CHAMAR	Chauliognathus marginatus	31	52	Beetles
COESAY	Coelioxys sayi	3	0	Bees & Wasps
COLHOW	Colletes howardi	1	0	Bees & Wasps
COLLON	Colletes longifacies	2	0	Bees & Wasps
CRASP.4	Crabronidae sp. 4	1	0	Bees & Wasps
DANPLE	Danaus plexippus	0	1	Butterflies & Moths
DASSP.	Dasymutilla sp.	0	2	Bees & Wasps
ERYHOR	Erynnis horatius	0	1	Butterflies & Moths
EUPSEP	Euphoria sepulcralis	1	0	Beetles
EXOFASP	Exoprosopa fascipennis	1	1	Flies
GERSP.	Geron sp.	1	0	Flies
GERVIT	Geron vitripennis	0	1	Flies
HABLAB	Habropoda laboriosa	0	1	Bees & Wasps
HEMCER	Hemiargus ceraunus	11	2	Butterflies & Moths
HOPSPO	Hoplitis spoliata	0	1	Bees & Wasps
HYLPHY	Hylephila phyleus	0	1	Butterflies & Moths
ISOEXO	Isodontia exornata	0	1	Bees & Wasps
ISOMEX	Isodontia mexicana	1	0	Bees & Wasps

JUNCOE	Junonia coenia	0	1	Butterflies & Moths
LASAPO	Lasioglossum apopkense	1	2	Bees & Wasps
LASCRE	Lasioglossum creberrimum	2	1	Bees & Wasps
LASFLO	Lasioglossum floridanum	2	4	Bees & Wasps
LASLON	Lasioglossum longifrons	6	0	Bees & Wasps
LASNYM	Lasioglossum nymphale	19	6	Bees & Wasps
LASRET	Lasioglossum reticulatum	2	2	Bees & Wasps
LASSP.2	Lasioglossum Sp. 2	0	1	Bees & Wasps
LIRPAN	Liris panamensis muesebecki	0	1	Bees & Wasps
MACCRU	Macrosiagon cruenta	1	0	Beetles
MEGADD	Megachile addenda	1	0	Bees & Wasps
MEGALB	Megachile albitarsis	1	0	Bees & Wasps
MEGBRE	Megachile brevis	3	5	Bees & Wasps
MEGGEO	Megachile georgica	5	0	Bees & Wasps
MEGINT	Megachile integra	3	4	Bees & Wasps
MEGINTL	Megachile integrella	0	2	Bees & Wasps
MEGMEN	Megachile mendica	3	2	Bees & Wasps
MEGMUC	Megachile mucida	0	1	Bees & Wasps
MEGPAR	Megachile parallela	2	2	Bees & Wasps
MEGPAR_ALB	Megachile parallela/albitarsis	0	1	Bees & Wasps
MEGPET	Megachile petulans	0	1	Bees & Wasps
MEGPSE	Megachile pseudobrevis	1	0	Bees & Wasps
MEGRUB	Megachile rubi	4	0	Bees & Wasps
MEGSP.	Megachile sp.	1	0	Bees & Wasps
MEGTEX	Megachile texana	0	1	Bees & Wasps
MELAPI	Melissodes apicatus	0	1	Bees & Wasps
MELCOM	Melissodes communis	0	2	Bees & Wasps
MELDEN	Melissodes denticulatus	0	1	Bees & Wasps
MELFIM	Melissodes fimbriatus	0	1	Bees & Wasps
MELMAN	Melissodes manipularis	0	3	Bees & Wasps
MERACU	Meromacrus acutus	1	0	Flies
MICMIC	microlep	1	1	Butterflies & Moths
MONQUA	Monobia quadridens	0	1	Bees & Wasps
MORATR	Mordella atrata	10	0	Beetles
MORMAR	Mordella marginata	1	1	Beetles
MORMOR	Mordellidae	7	2	Beetles
MUSFLY	muscoid fly	3	3	Flies
MYZMAC	Myzinum maculatum	5	1	Bees & Wasps
NEMPUN	Nemognatha punctulata	0	1	Beetles
NEMSP.	Nemognatha sp.	1	0	Beetles
NOMMAN	Nomia maneei	0	10	Bees & Wasps
OCYFUS	Ocyptamus fuscipennis	1	0	Flies
OSMSAN	Osmia sandhouseae	0	1	Bees & Wasps
PACERY	Pachodynerus erynnis	0	3	Bees & Wasps

PALVIN	Palpada vinetorum	1	0	Flies
PANOCO	Panoquina ocola	3	0	Butterflies & Moths
PARFUN	Paracyphononyx funereus	0	2	Bees & Wasps
PARSAL	Parancistrocerus salcularis	0	3	Bees & Wasps
PARTEX	Paratiphia texana	0	1	Bees & Wasps
PERBIS	Perdita bishoppi	2	0	Bees & Wasps
PERBRA	Perdita bradleyi/townesi	1	0	Bees & Wasps
PERCON	Perdita consobrina	2	0	Bees & Wasps
POEPUN	Poeciliognathus punctipennis	3	1	Flies
POESUL	Poeciliognathus sulphureus	13	1	Flies
POLBEL	Polistes bellicosus	1	0	Bees & Wasps
POLEXC	Polistes exclamans	1	1	Bees & Wasps
POLFUS	Polistes fuscatus	1	1	Bees & Wasps
POLTHE	Polites themistocles	1	0	Butterflies & Moths
POLVIB	Polites vibex	3	2	Butterflies & Moths
PRITHO	Prionyx thomae	1	0	Bees & Wasps
PYRLIS	Pyrisitia lisa	1	1	Butterflies & Moths
SATFAV	Satyrium favonius	1	0	Butterflies & Moths
SPHPEN	Sphex pensylvanicus	1	0	Bees & Wasps
STEOCU	Stenodynerus oculeus	0	3	Bees & Wasps
STEPULSUF	Stenodynerus pulvinatus surrufus	0	1	Bees & Wasps
STRMEL	Strymon melinus	2	0	Butterflies & Moths
STRSEX	Stranglia sexnotata	3	2	Beetles
TACAUR	Tachytes auricomans	1	0	Bees & Wasps
TACDIS	Tachytes distinctus	0	2	Bees & Wasps
TACINT	Tachytes intermedius	1	0	Bees & Wasps
TACMER	Tachytes mergus	1	0	Bees & Wasps
THOCON	Thorybes confusis	0	1	Butterflies & Moths
TIPSP.	Tiphia sp.	0	1	Bees & Wasps
TRARID	Trachusa ridingsii	1	0	Bees & Wasps
TRIDEL	Trigonopeltastes delta	10	15	Beetles
TRIGEO	Triepeolus georgicus	1	0	Bees & Wasps
TRIRUF	Trichiotinus rufobrunneus	1	0	Beetles
TRISPP	Trichiotinus spp.	4	1	Beetles
TYPSIN	Typocerus sinuatus	1	0	Beetles
TYPZEB	Typocerus zebra	2	1	Beetles
UNKMOT	unknown moth	1	0	Butterflies & Moths
UNKSKI	unknown skipper	1	0	Butterflies & Moths
URBPRO	Urbanus proteus	6	2	Butterflies & Moths
UTEORN	Utetheisa ornatrix	1	0	Butterflies & Moths
VANCAR	Vanessa cardui	1	2	Butterflies & Moths
XYLMIC	Xylocopa micans	0	1	Bees & Wasps
XYLVIR	Xylocopa virginica	8	15	Bees & Wasps
ZODAME	Zodion americanum	1	0	Flies

Plant Code Key for network diagrams, with plot occurrence data

		Relative Frequency (% of quads in which present)		
Code	**Species**	**BC1**	**BC2**	**Plant Type**
AESVIS	Aeschynomene viscidula	0	2	Forb
ASCCIN	Asclepias cineria	0	1	Forb
ASIINC	Asimina incana	20	19	Shrub
AURPEC	Aureolaria pectinata	1	1	Forb
BALANG	Balduina angustifolia	6	4	Forb
BAPLAN	Baptisia lanceolata	0	8	Forb
BAPLEC	Baptisia lecontei	8	5	Forb
CALGRA	Callisia graminea	3	1	Forb
CARCOR	Carphephorus corymbosus	63	58	Forb
CENVIR	Centrosema virginianum	1	0	Forb
CHANIC	Chamaecrista nictitans	9	18	Forb
CHRSCA	Chrysopsis scabrella	19	0	Forb
CNISTI	Cnidoscolus stimulosus	6	13	Forb
COMERE	Commelina erecta	8	2	Forb
CONCAN	Conyza canadensis	5	2	Forb
CROARG	Croton argyranthemus	3	4	Forb
CROROT	Crotalaria rotundifolia	52	15	Forb
DALPIN	Dalea pinnata	27	0	Forb
DIOSVI	Diospyros virginiana	0	2	Shrub
ELEELA	Elephantopus elatus	0	8	Forb
ERITOM	Eriogonum tomentosum	17	12	Forb
ERYARO	Eryngium aromaticum	9	7	Forb
EUPALB	Eupatorium album	41	3	Forb
EUPCOM	Eupatorium compositifolium	33	14	Forb
GALFLO_MIC	Galactia floridana/michauxii	78	67	Forb
GAYDUM	Gaylussacia dumosa	0	16	Shrub
GEOOBL	Geobalanus oblongifolius	1	1	Forb
HIEMEG	Hieracium megacephalon	5	3	Forb
LESHIR	Lespedeza hirta	1	2	Forb
LESREP	Lespedeza repens	8	0	Forb
LIATEN	Liatris tenuifolia	17	16	Forb
LUPVIL	Lupinus villosus	1	1	Forb
LYGAPH	Lygodesmia aphylla	1	2	Forb
MIMQUA	Mimosa quadrivalvis	4	2	Forb
PALINT	Palafoxia integrifolia	71	0	Forb
PITGRA	Pityopsis graminifolia	33	15	Forb
POLPIN	Polygonum pinicola	7	0	Forb
PTEPYC	Pterocaulon pycnostachyum	4	3	Forb
RHUCOP	Rhus copallinum	10	43	Shrub
RHYREN	Rhynchosia reniformis	18	7	Forb
RUBCUN	Rubus cuneifolius	3	11	Shrub

Plant Code Key for network diagrams cont'd

RUECAR	Ruellia caroliniensis	0	1	Forb
SCUINT	Scutellaria integrifolia	0	2	Forb
SERREP	Serenoa repens	34	18	Shrub
SERTOR	Sericocarpus tortifolius	27	17	Forb
SILCOM	Silphium compositum	0	1	Forb
SMIAUR	Smilax auriculata	18	52	Shrub
SOLODO	Solidago odora	14	16	Forb
STISYL	Stillingia sylvatica	40	23	Forb
STYBIF	Stylosanthes biflora	13	2	Forb
STYPAT	Stylisma patens	10	12	Forb
TEPCHR_SPI	Tephrosia chrysophylla/spicata	28	0	Forb
TEPFLO	Tephrosia florida	0	11	Forb
VACARB	Vaccinium arboreum	52	56	Shrub
VACMYR	Vaccinium myrsinites	4	9	Shrub
VACSTA	Vaccinium stamineum	32	49	Shrub
YUCFIL	Yucca filamentosa	3	0	Shrub

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Additional Resources

For more information on the natural history and identification of the insects we found at Black Creek, 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 Black Creek, 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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Credits for Photos not taken by FWRI

Typocerus (Judy Gallagher), *Agaulis* (Art Shapiro), *Nomia* (© Laura Zurro/iNaturalist), *Polites* (JN Dell/BugGuide), *Meromacrus* (Celeste S./BugGuide), *Ocyptamus* © Odin Toness/BugGuide

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