Plant-Pollinator Networks in Fire-Maintained Sandhills

Research Study (2019-2020)

Ordway-Swisher Biological Station

Site-specific results

OR3

OR2

OR1

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Introduction

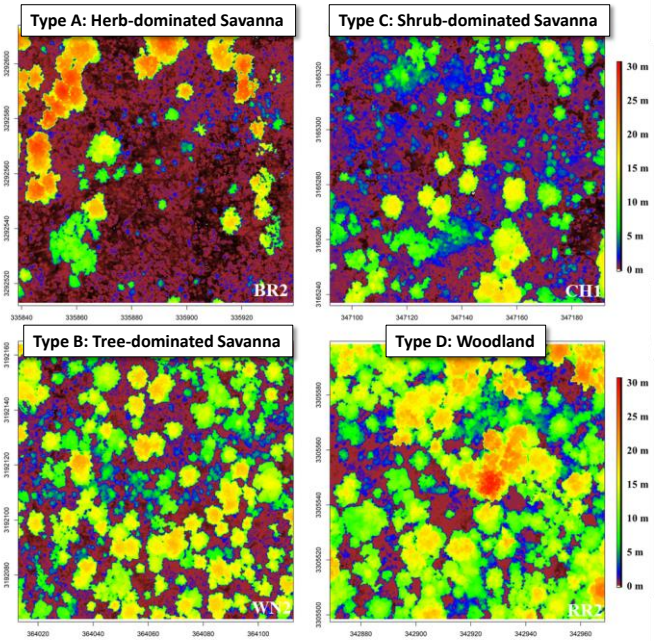
In Florida's fire-dependent longleaf pine savannas, as in terrestrial ecosystems worldwide, the mutualistic interaction networks formed by flowering plants and pollinators are of fundamental importance for the maintenance of biodiversity (Bascompte and Jordano 2007). Florida is part of the North American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

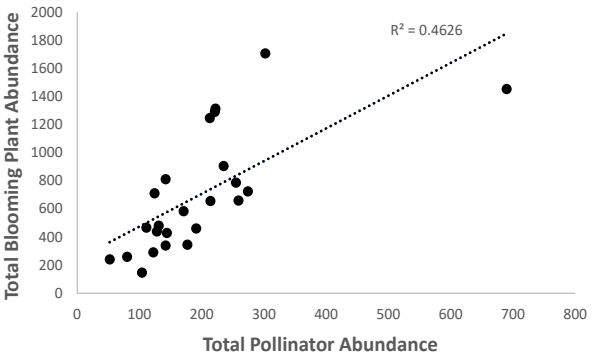


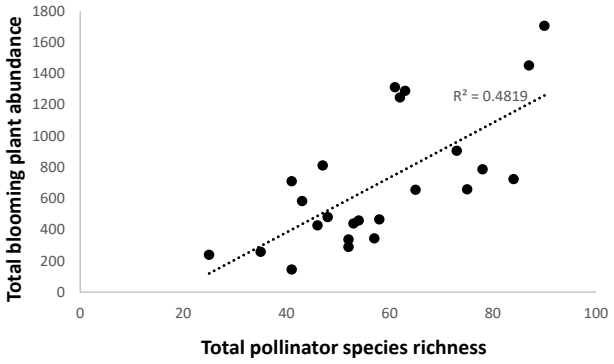
Overall Study Results: Vegetation Structure

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.

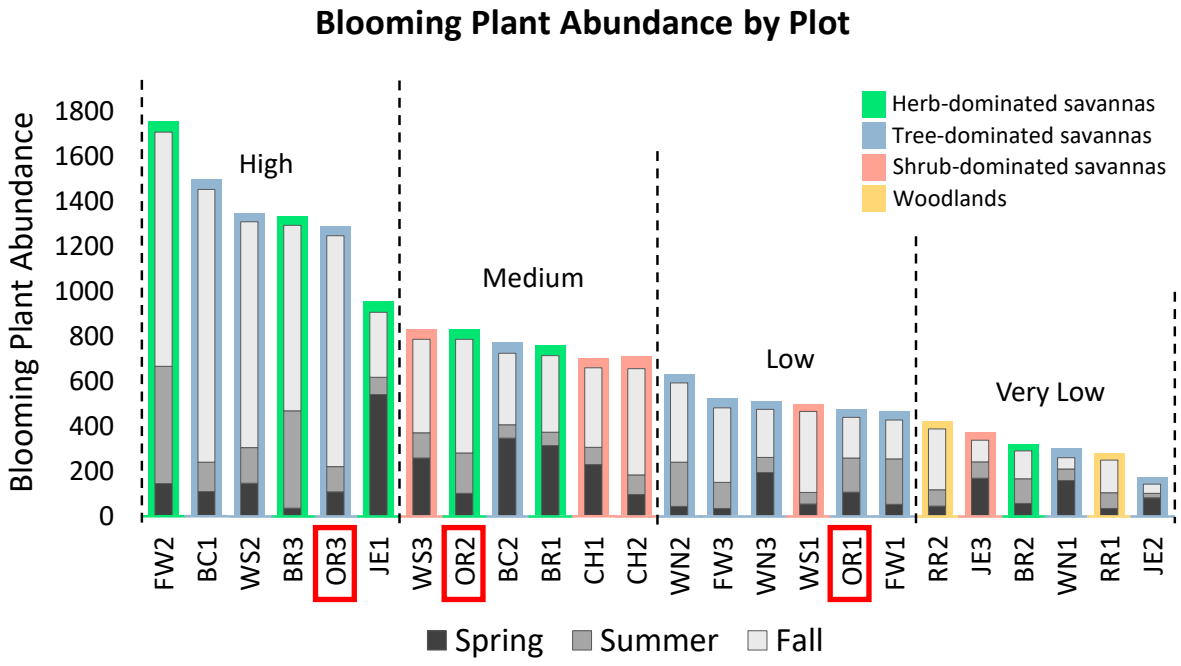




We found that the spring bloom season in longleaf pine sandhills is dominated by shrubs (particularly saw palmetto and blueberries), while the fall bloom season is dominated by herbaceous plants (especially members of the Asteraceae or sunflower family). Most of the herb-dominated plots in the study 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/.

Ordway Results: Stand Structure and Flower Abundance

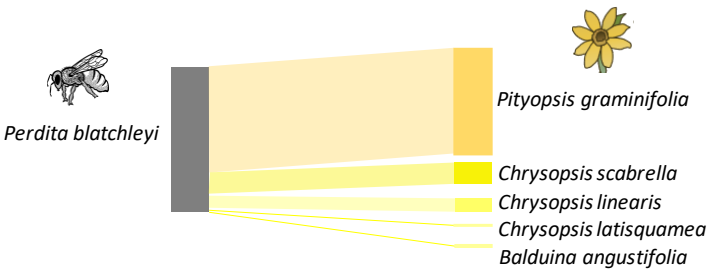
Ordway had one herb-dominated plot and two tree-dominated plots: Plot **OR2** is an herb-dominated savanna, and plots **OR1** and **OR3** are tree-dominated savannas. Plot OR2, an herb-dominated savanna, had moderate blooming plant abundance, while Plot OR1 was in the low flower abundance quantile, and Plot OR3 was in the high flower abundance quantile. Plot OR2 was particularly notable for its high abundance of *Eryngium aromaticum*, a plant in the carrot family that is highly attractive to many pollinator species, and plot OR3 was characterized by a very high abundance of *Pityopsis graminifolia,* a key late-fall pollinator attractant. Plot OR1 has been undergoing restoration in recent years to open the canopy, and these changes may result in higher herbaceous cover and wildflower abundance in the coming years.



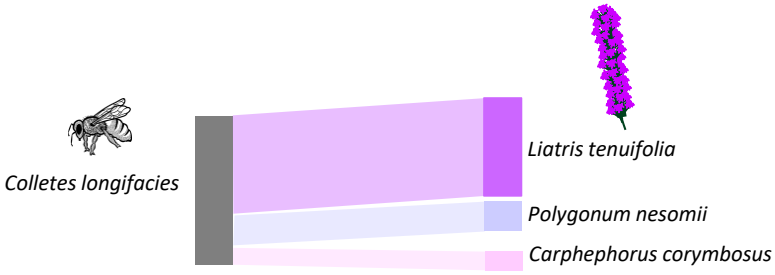
Ordway Results: Pollinator Overview

Pollinator abundance and species diversity varied dramatically between plots at Ordway. Plot OR2 had the highest overall pollinator abundance and diversity of the three Ordway plots, despite having lower overall flower abundance than plot OR3. This was likely due to the species of flowers present in plot OR2, particularly *Eryngium aromaticum.* Hymenoptera (Bee & Wasp) richness was highest in plot OR2, and was low to very low in plots OR1 and OR3. Diptera (Flies) and Coleoptera (beetles) had moderate to high abundance in both OR2 and OR3, and lower abundance in plot OR1. Lepidoptera (Butterfly & Moth) abundance was high in all three plots, though species richness in this group was low in plot OR3. Order-specific pollinator results are presented in greater detail on the following pages, followed by plant-pollinator network diagrams for each plot.

We found two bee Species of Greatest Conservation Need (SGCN) at Ordway: *Perdita blatchleyi* 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.

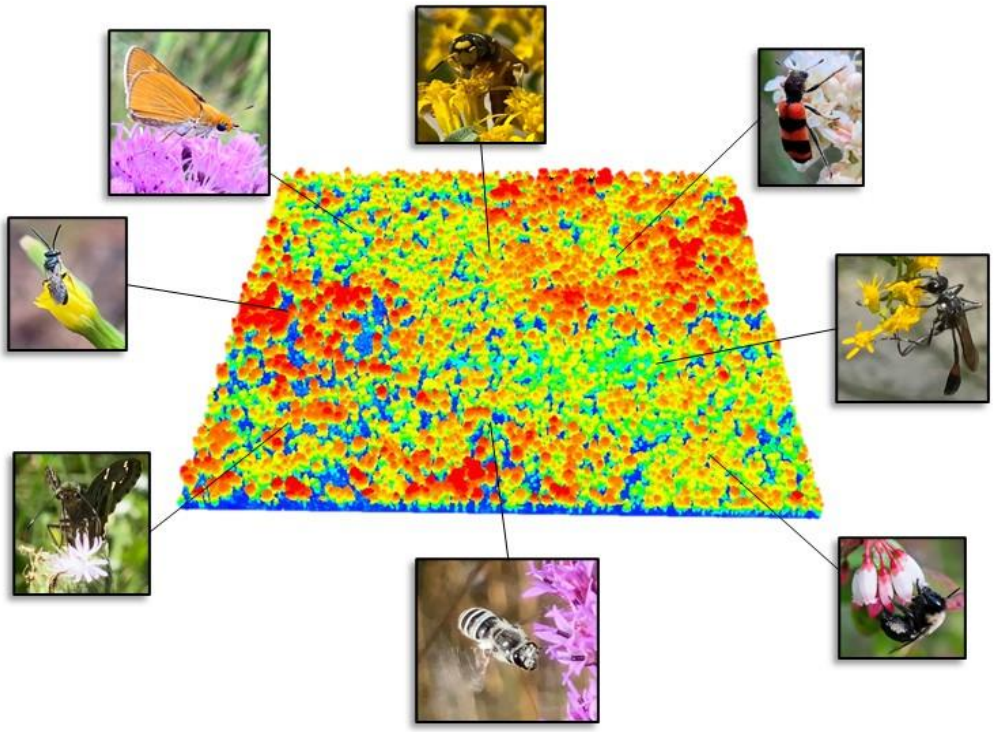


Flower interactions of *Perdita blatchleyi*, based on 103 observations recorded during the project.



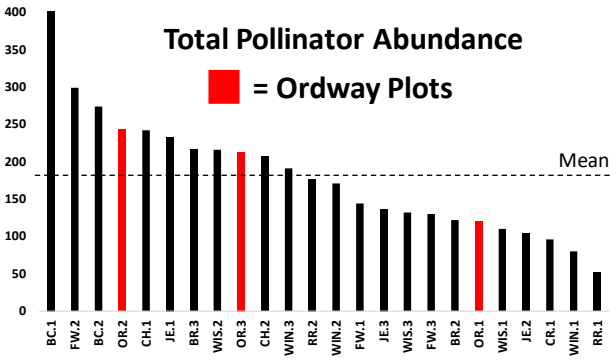
Flower interactions of *Colletes longifacies*, based on 24 observations recorded during the project.

Ordway-Swisher Results
Pollinator Abundance and Species Richness



Overall Pollinator Abundance and Species Richness

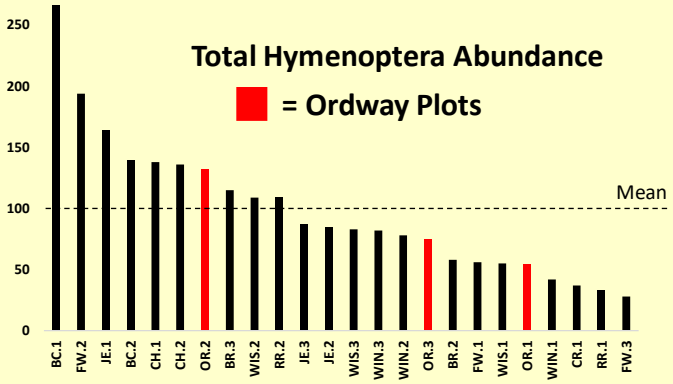
	Abundance # of individuals		Species Richness	
	Total	Rank	Total	Rank
Plot **OR1**	128	Med-Low	52	Med-Low
Plot **OR2**	255	Med-High	77	High
Plot **OR3**	213	Med-High	62	Med-High
Study Average	181.6		57.6	
Study Range	52 - 402		25 - 90	



The above table shows the total pollinator abundance (number of individual insects caught) and total pollinator species richness for the three study plots at Ordway, along with their quantile rank relative to the entire 24-plot study. Total pollinator abundance and species richness were above the study average in plots OR2 and OR3, and below average in plot OR1. These differences are likely related to differences in plot structure and flower abundance.

Hymenoptera (Bees & Wasps)

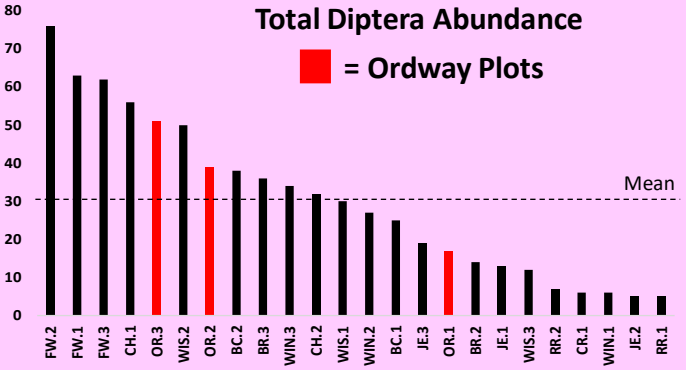
	Abundance # of individuals		Species Richness	
	Total	Rank	Total	Rank
Plot **OR1**	54	Med-Low	23	Med-Low
Plot **OR2**	132	Med-High	47	High
Plot **OR3**	75	Med-Low	31	Med-Low
Study Average	98.1		33.6	
Study Range	28 - 266		12 - 61	



Bee & wasp species richness and abundance were high in plot OR2, and medium-low in plots OR1 and OR3. Five of the most abundant native Hymenopteran species at Ordway were *Megachile mendica* (Beggar Leafcutter Bee), *Augochloropsis sumptuosa* (a sweat bee), *Bombus impatiens* (Eastern Bumble Bee), *Perdita sp.* (a fairy bee), and *Lasioglossum apopkense* (a sweat bee).

Diptera (Flies)

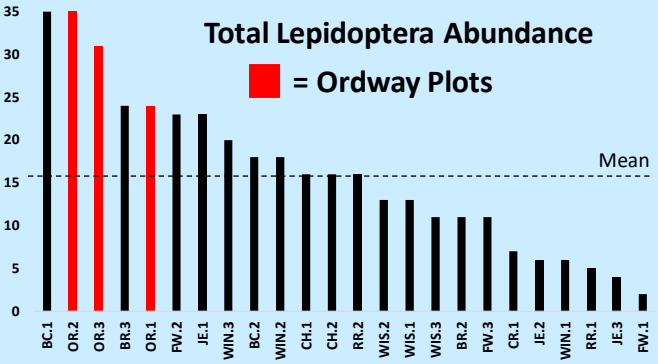
	Abundance # of individuals		Species Richness	
	Total	Rank	Total	Rank
Plot **OR1**	17	Med-Low	7	Med-High
Plot **OR2**	39	Med-High	7	Med-High
Plot **OR3**	51	Med-High	14	High
Study Average	30.1		7.6	
Study Range	5 - 79		2 - 18	



Dipteran abundance was moderate to high in all of the plots at Ordway, with particularly high native species richness in plot OR3. The most frequently observed Dipteran species at Ordway were *Poeciliognathus sulphureus* (Sulphurous bee fly), *Exoprosopa fasciata* (Banded bee fly), *Poeciliognathus punctipennis* (A bee fly), *Geron vitripennis* (Glassy-winged bee fly), and *Physoconops excisus* (A thick-headed fly). *Credits for non-FWRI photos on last page.

Lepidoptera (Butterflies & Moths)

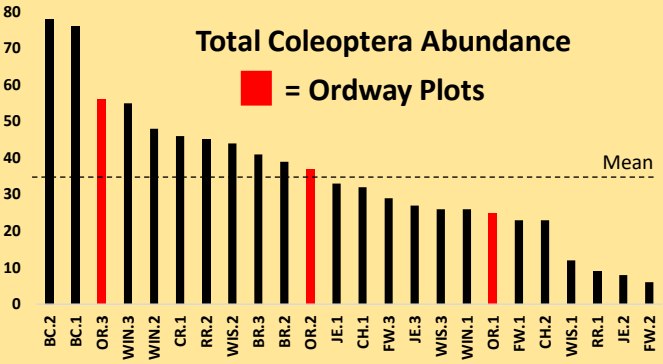
	Abundance (# of individuals)		Species Richness	
	Total	Rank	Total	Rank
Plot **OR1**	24	Med-High	13	High
Plot **OR2**	35	High	10	Med-High
Plot **OR3**	31	High	8	Med-Low
Study Average	16.2		8.1	
Study Range	2 - 35		2 - 14	



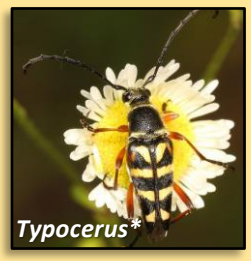
Butterfly & moth abundance was high in all of the Ordway plots, and species richness was moderate to high in all plots. The most frequently observed Lepidopteran species were *Hemiargus ceraunus* (Ceraunus Blue) *Junonia coenia* (Common Buckeye), *Erynnis horiatus* (Horace's Duskywing), *Strymon melinus* (Gray Hairstreak), and *Urbanus proteus* (Long-Tailed Skipper). *Credits for non-FWRI photos on last page.

Coleoptera (Beetles)

	Abundance # of Individuals		Species Richness	
	Total	Rank	Total	Rank
Plot **OR1**	25	Med-Low	9	Med-High
Plot **OR2**	37	Med-High	13	High
Plot **OR3**	56	High	9	Med-High
Study Average	35.2		8.0	
Study Range	6 - 78		4 - 14	

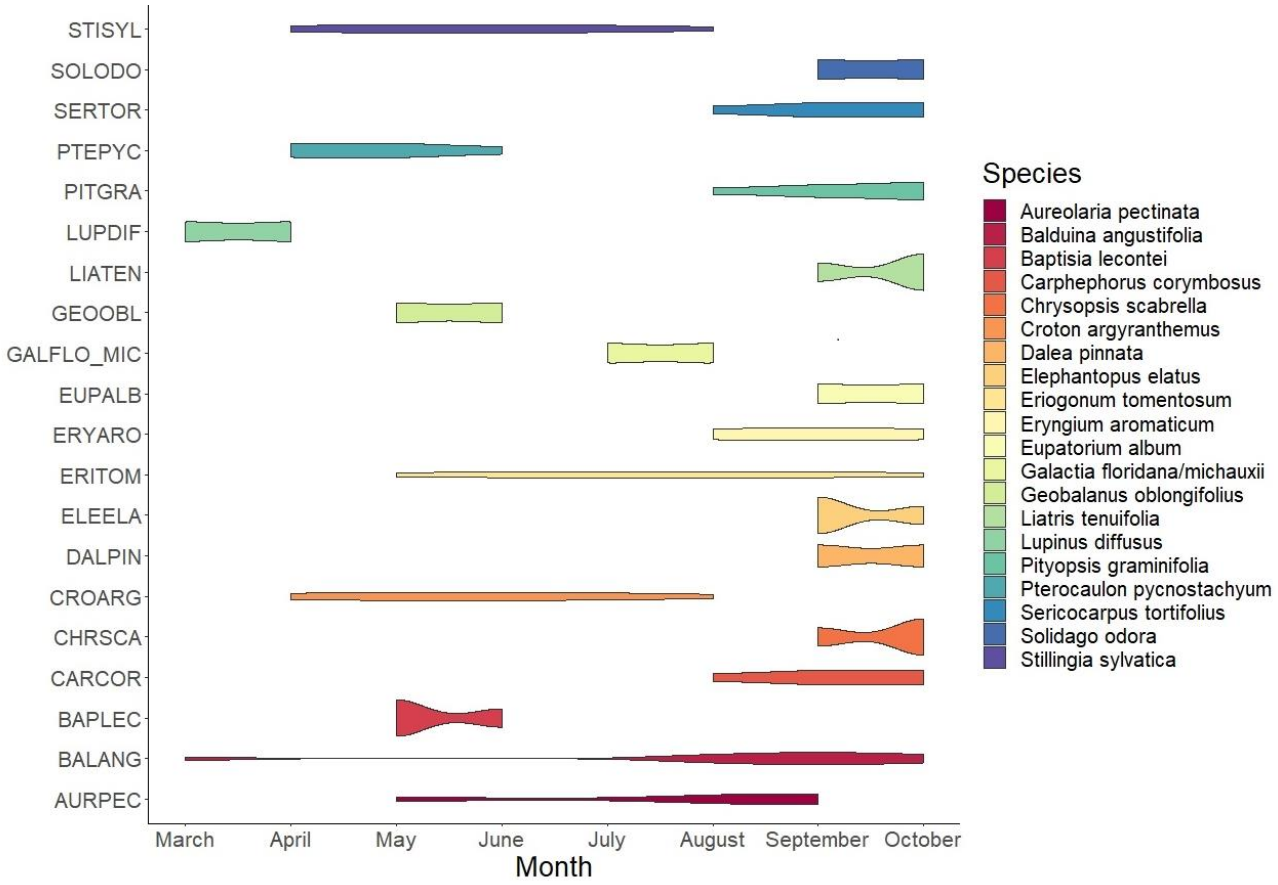


Beetle species richness and abundance were moderate to high in all of the Ordway plots. The most abundant beetle pollinator species at Ordway were *Epicauta sp.* (Blister Beetles), *Mordella atrata* (Tumbling Flower Beetle), *Acmaeodera pulchella* (Bald-cypress sapwood beetle), *Trigonopeltastes delta* (Delta Flower Beetle), and *Typocerus zebra* (Zebra Flower Longhorn). *Credits for non-FWRI photos on last page.

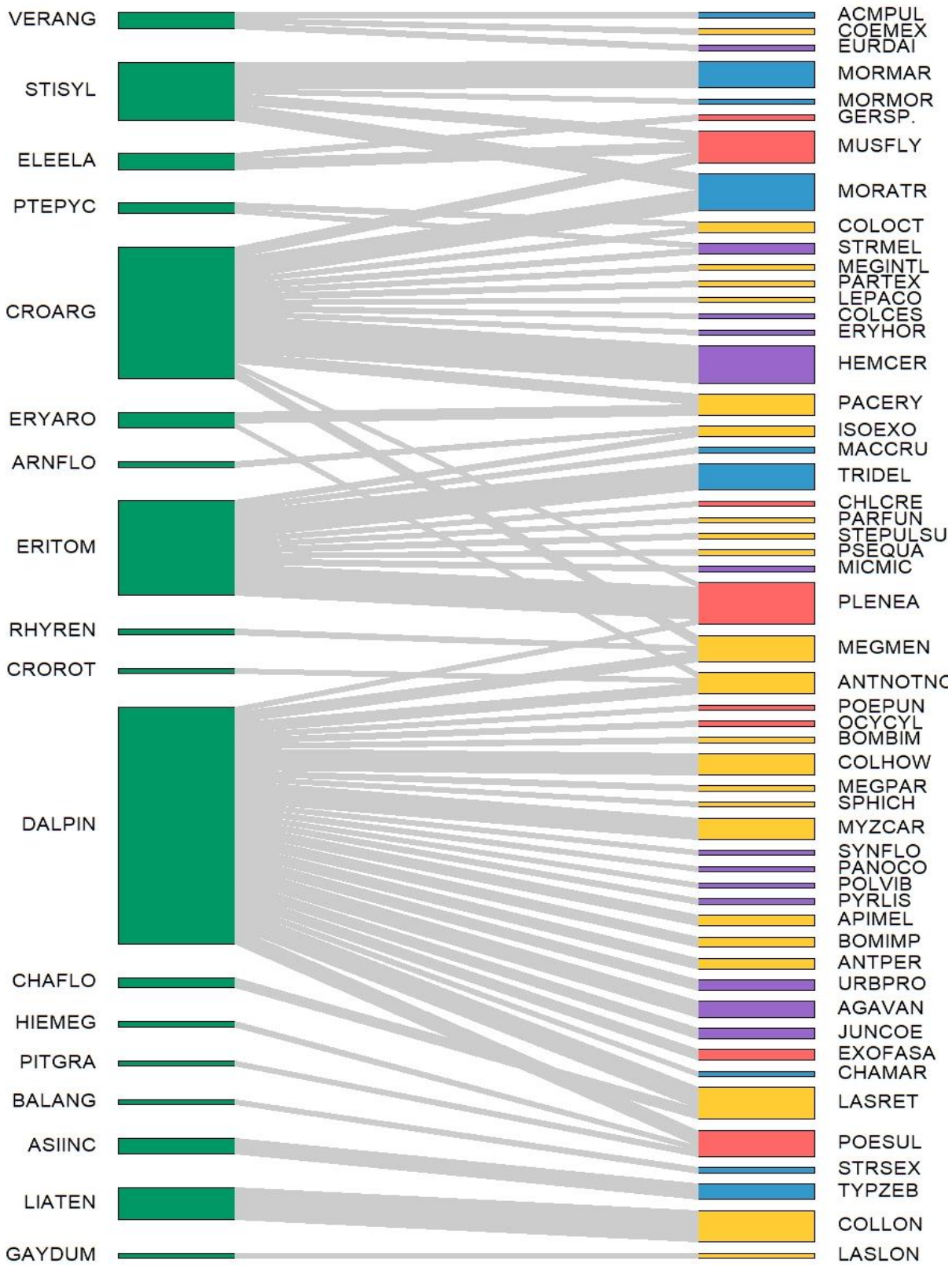


Key flowering plant species

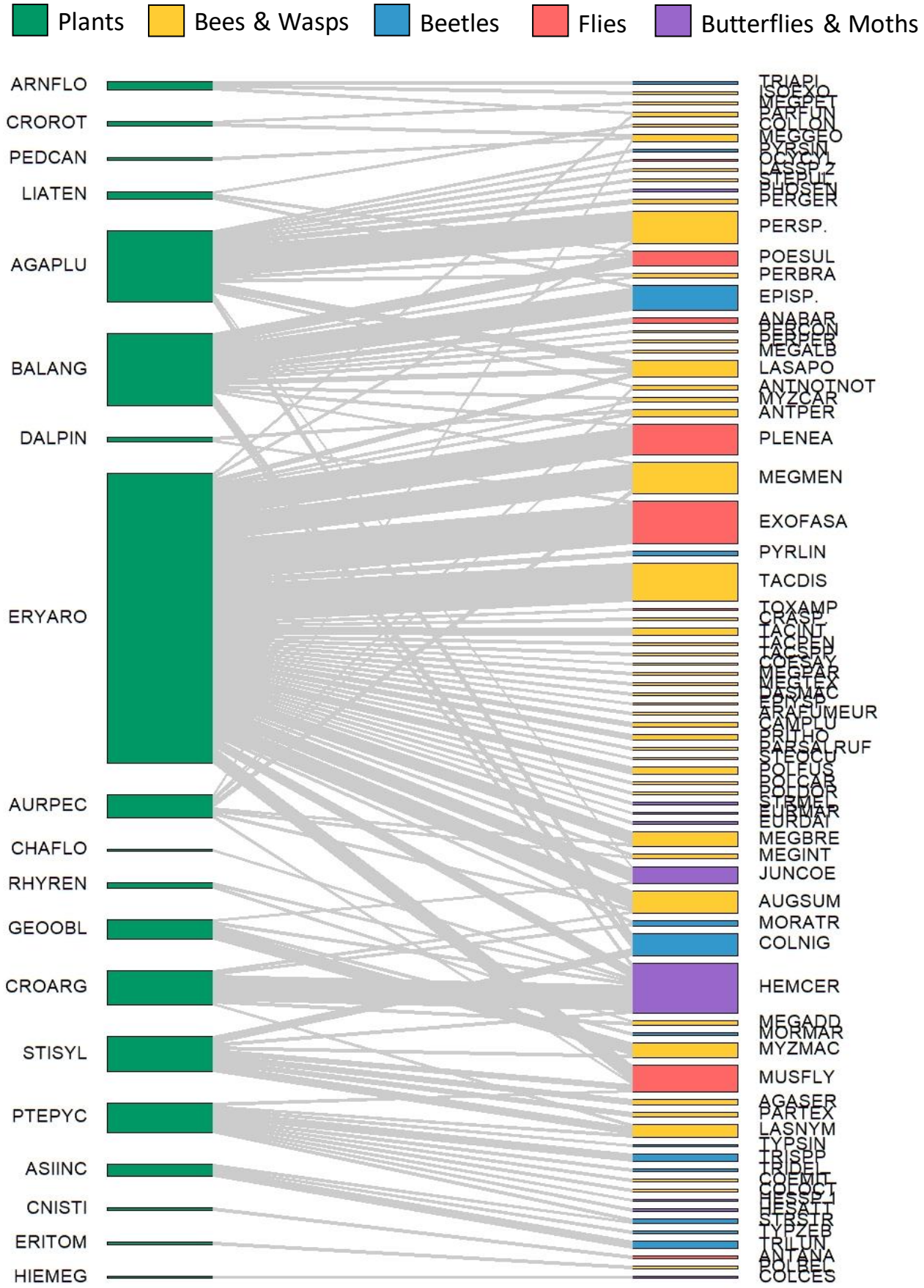
We identified 20 of the most important herbaceous flowering species that were present on multiple sites and had high pollinator interaction rates throughout the study. Many of these species, shown in the graphic below with their blooming time/duration, were prevalent in the Ordway sandhills.



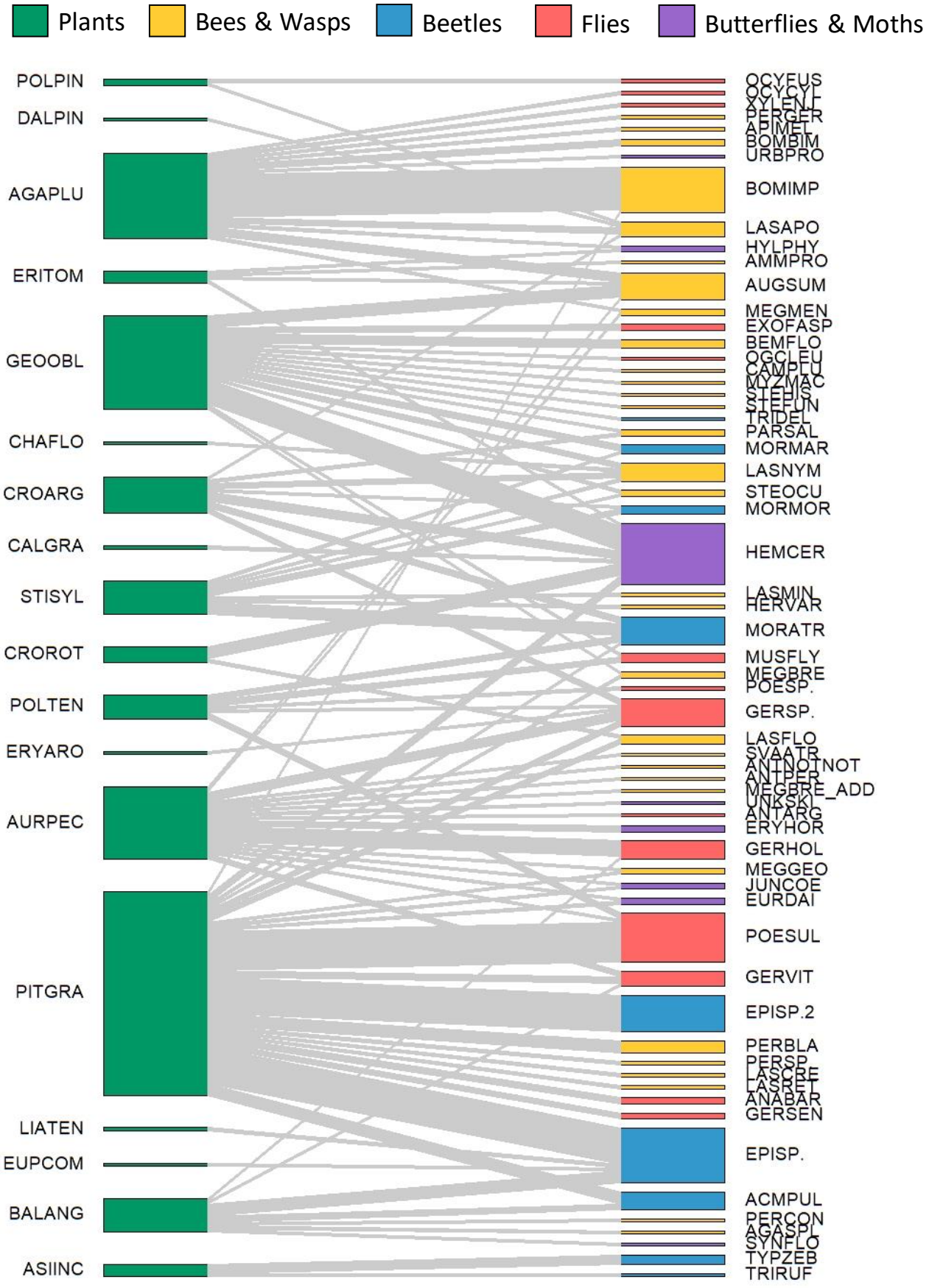
OR1 Plant-Pollinator Network *Plant and insect code key included at end of report



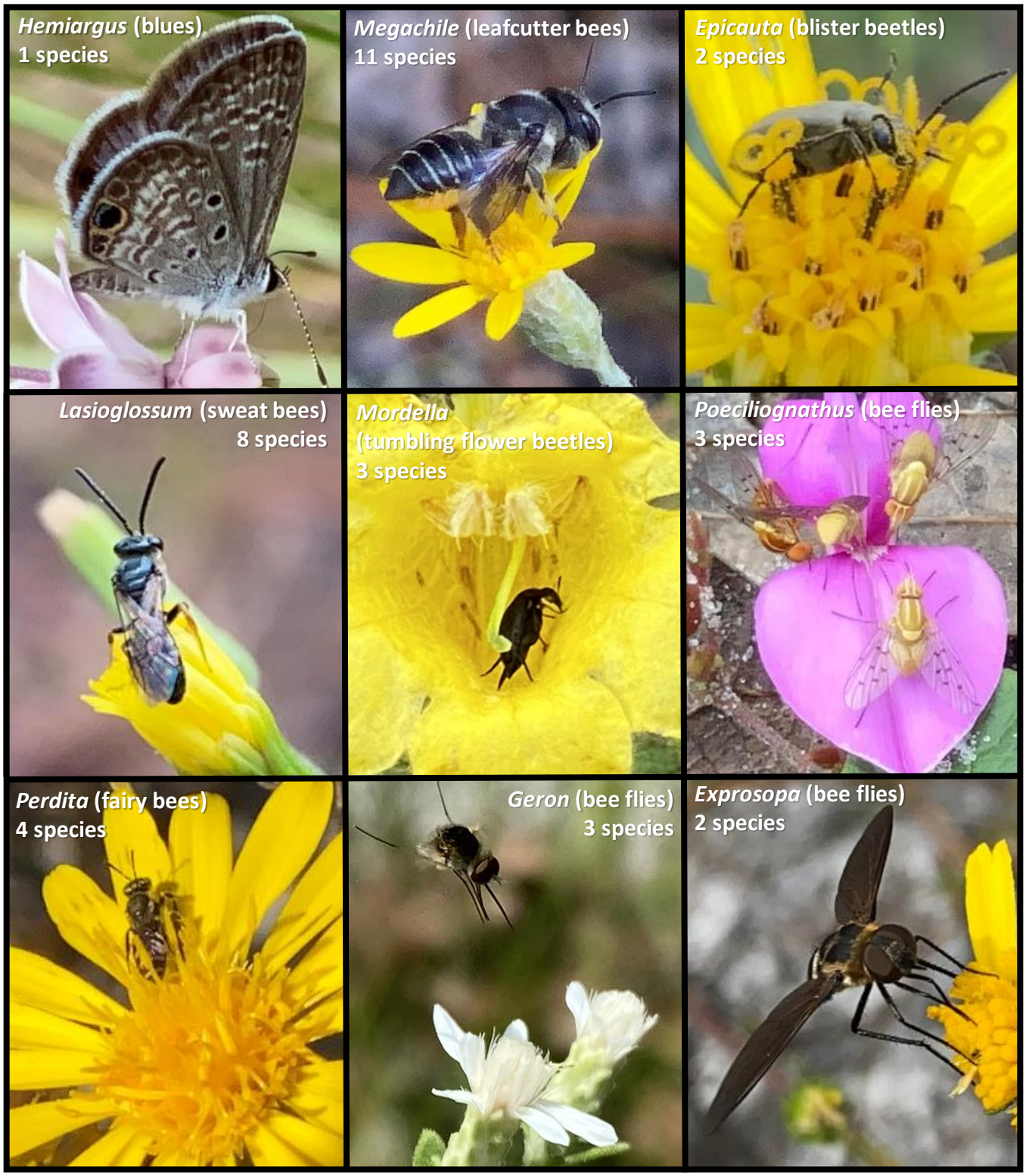
OR2 Plant-Pollinator Network *Plant and insect code key included at end of report



OR3 Plant-Pollinator Network *Plant and insect code key included at end of report



Most frequently observed pollinator genera at Ordway



Insect Code Key for network diagrams, with plot occurrence data

		Number Caught			
Code	**Species**	**OR-1**	**OR-2**	**OR-3**	**Insect type**
ACMPUL	Acmaeodera pulchella	1	0	6	Beetles
AGASER	Agapostemon sericeus	0	2	0	Bees & Wasps
AGASPL	Agapostemon splendens	0	0	1	Bees & Wasps
AGAVAN	Agaulis vanillae	3	0	0	Butterflies & Moths
AMMPRO	Ammophila procera	0	0	1	Bees & Wasps
ANABAR	Anastoechus barbatus	0	2	2	Flies
ANTANA	Anthrax analis	0	1	0	Flies
ANTARG	Anthrax argyropygus	0	0	1	Flies
ANTNOTNOT	Anthidiellum notatum nota	4	2	1	Bees & Wasps
ANTPER	Anthidiellum perplexum	2	3	1	Bees & Wasps
APIMEL	Apis mellifera	2	0	1	Bees & Wasps
ARAFUMEUR	Arachnospila fumipennis eu	0	1	0	Bees & Wasps
AUGSUM	Augochloropsis sumptuosa	0	9	9	Bees & Wasps
BATPHI	Battus philenor	0	1	0	Butterflies & Moths
BEMFLO	Bembecinus floridanus	0	0	3	Bees & Wasps
BOMBIM	Bombus bimaculatus	1	0	2	Bees & Wasps
BOMIMP	Bombus impatiens	2	0	15	Bees & Wasps
CAMPLU	Campsomeris plumipes fos	0	2	1	Bees & Wasps
CHAMAR	Chauliognathus marginatus	1	0	0	Beetles
CHLCRE	Chlorotabanus crespusclari	1	0	0	Flies
COEMEX	Coelioxys mexicanus	1	0	0	Bees & Wasps
COEMIT	Coelioxys mitchelli	0	1	0	Bees & Wasps
COESAY	Coelioxys sayi	0	1	0	Bees & Wasps
COLCES	Colias cesonia	1	1	0	Butterflies & Moths
COLHOW	Colletes howardi	4	0	0	Bees & Wasps
COLLON	Colletes longifacies	6	1	0	Bees & Wasps
COLNIG	Collops nigriceps	0	9	0	Beetles
COLOCT	Colpa octomaculata	2	1	0	Bees & Wasps
CRASP.	Crabro sp. B	0	1	0	Bees & Wasps
DASMAC	Dasymutilla macilenta	0	1	0	Bees & Wasps
EPISP.	Epicauta sp.	0	10	18	Beetles
EPISP.2	Epicauta sp. 2	0	0	12	Beetles
EPIYSP.	Episyron sp.	0	1	0	Bees & Wasps
ERYHOR	Erynnis horatius	1	0	2	Butterflies & Moths
EURDAI	Eurema daira	1	1	2	Butterflies & Moths
EURMAR	Eurytides marcellus	0	1	0	Butterflies & Moths
EXOFASA	Exoprosopa fasciata	2	17	0	Flies
EXOFASP	Exoprosopa fascipennis	0	0	2	Flies
GERHOL	Geron holosericeus	0	0	6	Flies
GERSEN	Geron senilis	0	0	2	Flies
GERSP.	Geron sp.	1	0	9	Flies
GERVIT	Geron vitripennis	0	0	5	Flies

HEMCER	Hemiargus ceraunus	7	20	20	Butterflies & Moths
HERVAR	Heriades variolosa	0	0	1	Bees & Wasps
HESATT	Hesperia attalus slossonae	0	1	0	Butterflies & Moths
HESSP.1	Hesperiidae sp. 1	0	1	0	Butterflies & Moths
HYLPHY	Hylephila phyleus	0	0	2	Butterflies & Moths
ISOEXO	Isodontia exornata	2	1	0	Bees & Wasps
JUNCOE	Junonia coenia	2	7	2	Butterflies & Moths
LASAPO	Lasioglossum apopkense	0	7	5	Bees & Wasps
LASCRE	Lasioglossum creberrimum	0	0	1	Bees & Wasps
LASFLO	Lasioglossum floridanum	0	0	3	Bees & Wasps
LASLON	Lasioglossum longifrons	1	0	0	Bees & Wasps
LASMIN	Lasioglossum miniatulum	0	0	1	Bees & Wasps
LASNYM	Lasioglossum nymphale	0	5	6	Bees & Wasps
LASRET	Lasioglossum reticulatum	6	0	1	Bees & Wasps
LASSP.2	Lasioglossum Sp. 2	0	1	0	Bees & Wasps
LEPACO	Leptochilus acolhuus	1	0	0	Bees & Wasps
MACCRU	Macrosiagon cruenta	1	0	0	Beetles
MEGADD	Megachile addenda	0	2	0	Bees & Wasps
MEGALB	Megachile albitarsis	0	1	0	Bees & Wasps
MEGBRE	Megachile brevis	0	6	2	Bees & Wasps
MEGBRE_ADD	Megachile brevis/addenda	0	0	1	Bees & Wasps
MEGGEO	Megachile georgica	0	3	2	Bees & Wasps
MEGINT	Megachile integra	0	2	0	Bees & Wasps
MEGINTL	Megachile integrella	1	0	0	Bees & Wasps
MEGMEN	Megachile mendica	5	13	2	Bees & Wasps
MEGPAR	Megachile parallela	1	1	0	Bees & Wasps
MEGPET	Megachile petulans	0	1	0	Bees & Wasps
MEGTEX	Megachile texana	0	1	0	Bees & Wasps
MICMIC	microlep	1	0	0	Butterflies & Moths
MORATR	Mordella atrata	7	2	9	Beetles
MORMAR	Mordella marginata	5	1	3	Beetles
MORMOR	Mordellidae	1	0	3	Beetles
MUSFLY	muscoid fly	6	11	3	Flies
MYZCAR	Myzinum carolinianum	4	2	0	Bees & Wasps
MYZMAC	Myzinum maculatum	0	6	1	Bees & Wasps
OCYCIL	Ocyptamus cylindricus	1	1	1	Flies
OCYFUS	Ocyptamus fuscipennis	0	0	1	Flies
OGCLEU	Ogcodocera leucoprocta	0	0	1	Flies
PACERY	Pachodynerus erynnis	4	0	0	Bees & Wasps
PANOCO	Panoquina ocola	1	0	0	Butterflies & Moths
PARFUN	Paracyphononyx funereus	1	2	0	Bees & Wasps
PARSAL	Parancistrocerus salcularis	0	0	2	Bees & Wasps
PARSALRUF	Parancistrocerus salcularis r	0	1	0	Bees & Wasps
PARTEX	Paratiphia texana	1	2	0	Bees & Wasps

PERBLA	Perdita blatchleyi	0	0	4	Bees & Wasps
PERBRA	Perdita bradleyi/townesi	0	2	0	Bees & Wasps
PERCON	Perdita consobrina	0	1	1	Bees & Wasps
PERGER	Perdita gerardiae	0	2	1	Bees & Wasps
PERPER	Perdita/Pseudopanurgus	0	1	0	Bees & Wasps
PERSP.	Perdita sp.	0	13	1	Bees & Wasps
PHOSEN	Phoebis sennae	0	1	0	Butterflies & Moths
PLENEA	Plecia nearctica	8	12	0	Flies
POEPUN	Poeciliognathus punctipenn	1	0	0	Flies
POESP.	Poecilognathus sp.	0	0	1	Flies
POESUL	Poeciliognathus sulphureus	5	6	16	Flies
POLBEL	Polistes bellicosus	0	1	0	Bees & Wasps
POLCAR	Polistes carolina	0	1	0	Bees & Wasps
POLDOR	Polistes dorsalis	0	1	0	Bees & Wasps
POLFUS	Polistes fuscatus	0	3	0	Bees & Wasps
POLVIB	Polites vibex	1	0	0	Butterflies & Moths
PRITHO	Prionyx thomae	0	2	0	Bees & Wasps
PSEQUA	Pseudodynerus quadrisectu	1	0	0	Bees & Wasps
PYRLIN	Pyrota lineata	0	2	0	Beetles
PYRLIS	Pyrisitia lisa	1	0	0	Butterflies & Moths
PYRSIN	Pyrota sinuata	0	1	0	Beetles
SPHICH	Sphex ichneumoneus	1	0	0	Bees & Wasps
STEFUN	Stenodynerus fundatiformi:	0	0	1	Bees & Wasps
STEHIS	Stenodynerus histrionalis	0	0	1	Bees & Wasps
STEOCU	Stenodynerus oculeus	0	1	2	Bees & Wasps
STEPUL	Stenodynerus pulvinatus	0	1	0	Bees & Wasps
STEPULSUF	Stenodynerus pulvinatus su	1	0	0	Bees & Wasps
STRMEL	Strymon melinus	2	1	0	Butterflies & Moths
STRSEX	Stranglia sexnotata	1	0	0	Beetles
STRSTR	Stranglia strigosa	0	2	0	Beetles
SVAATR	Svastra atripes	0	0	1	Bees & Wasps
SYNFLO	Syngamia florella	1	0	1	Butterflies & Moths
TACDIS	Tachytes distinctus	0	15	0	Bees & Wasps
TACINT	Tachytes intermedius	0	3	0	Bees & Wasps
TACPEN	Tachytes pennsylvanicus	0	1	0	Bees & Wasps
TACSPP	Tachytes spp.	0	1	0	Bees & Wasps
TOXAMP	Toxophora amphitea	0	1	0	Flies
TRIAPI	Trichodes apivorus	0	1	0	Beetles
TRIDEL	Trigonopeltastes delta	5	1	1	Beetles
TRILUN	Trichiotinus lunulatus	0	3	0	Beetles
TRIRUF	Trichiotinus rufobrunneus	0	0	1	Beetles
TRISPP	Trichiotinus spp.	0	3	0	Beetles
TYPSIN	Typocerus sinuatus	0	1	0	Beetles
TYPZEB	Typocerus zebra	3	1	3	Beetles
UNKSKI	unknown skipper	0	0	1	Butterflies & Moths
URBPRO	Urbanus proteus	2	0	1	Butterflies & Moths
XYLENJ	Xylota enjuncida	0	0	1	Flies

Plant Code Key for network diagrams, with plot occurrence data

		Relative Frequency			
		(% of quads in which present)			
Code	**Species**	**OR1**	**OR2**	**OR3**	**Plant Type**
AESVIS	Aeschynomene viscidula	3	0	0	Forb
AGAPLU	Agalinis plukenettii	0	49	32	Forb
AGEJUC	Ageratina jucunda	9	31	0	Forb
ASCHUM	Asclepias humistrata	0	1	1	Forb
ASCTUB	Asclepias tuberosa	0	1	0	Forb
ASCVER	Asclepias verticillata	0	5	0	Forb
ASIINC	Asimina incana	34	29	24	Shrub
AURPEC	Aureolaria pectinata	0	1	0	Forb
BALANG	Balduina angustifolia	0	35	28	Forb
CALGRA	Callisia graminea	0	3	2	Forb
CARCOR	Carphephorus corymbosus	8	6	7	Forb
CENVIR	Centrosema virginianum	31	26	9	Forb
CHAFLO	Chapmannia floridana	7	45	78	Forb
CHANIC	Chamaecrista nictitans	17	23	0	Forb
CNISTI	Cnidoscolus stimulosus	11	11	0	Forb
COMERE	Commelina erecta	1	2	0	Forb
CROARG	Croton argyranthemus	17	7	19	Forb
CROCAR	Crocantheumum carolinianum	9	0	0	Forb
CROCOR	Crocantheumum corymbosum	1	0	0	Forb
CROROT	Crotalaria rotundifolia	23	26	10	Forb
DALPIN	Dalea pinnata	17	5	0	Forb
DIOSVI	Diospyros virginiana	22	5	4	Shrub
ELEELA	Elephantopus elatus	23	0	0	Forb
ERITOM	Eriogonum tomentosum	44	32	20	Forb
ERYARO	Eryngium aromaticum	1	30	4	Forb
EUPALB	Eupatorium album	4	0	0	Forb
EUPCOM	Eupatorium compositifolium	0	0	2	Forb
GALFLO_M	Galactia floridana/michauxii	7	22	13	Forb
GEOOBL	Geobalanus oblongifolius	4	48	28	Forb
HIEMEG	Hieracium megacephalon	18	15	0	Forb
HYPSUF	Hypericum suffruticosum	3	0	0	Shrub
LACGRA	Lactuca graminifolia	2	0	0	Forb
LESHIR	Lespedeza hirta	33	6	1	Forb
LIATEN	Liatris tenuifolia	3	5	7	Forb
LYGAPH	Lygodesmia aphylla	0	1	0	Forb
MIMQUA	Mimosa quadrivalvis	2	0	0	Forb
OPUHUM	Opuntia humifusa	0	2	0	Forb

PALINT	Palafoxia integrifolia	2	6	32	Forb
PARPAT	Paronychia patula	0	0	2	Forb
PEDCAN	Pediomelum canescens	0	1	0	Forb
PITGRA	Pityopsis graminifolia	19	23	96	Forb
POLPIN	Polygonum pinicola	6	0	4	Forb
POLTEN	Polanisia tenuifolia	0	0	4	Forb
PTEPYC	Pterocaulon pycnostachyum	2	26	2	Forb
RHUCOP	Rhus copallinum	11	0	0	Shrub
RHYREN	Rhynchosia reniformis	6	13	1	Forb
RUECAR	Ruellia caroliniensis	7	1	0	Forb
RUECIL	Ruellia ciliosa	0	8	0	Forb
SCUINT	Scutellaria integrifolia	5	27	0	Forb
SERREP	Serenoa repens	5	1	0	Shrub
SERTOR	Sericocarpus tortifolius	14	7	0	Forb
SEYPEC	Seymeria pectinata	0	26	13	Forb
SILCOM	Silphium compositum	3	0	0	Forb
SMIAUR	Smilax auriculata	9	5	12	Shrub
SOLODO	Solidago odora	2	1	0	Forb
STISYL	Stillingia sylvatica	21	38	21	Forb
STYBIF	Stylosanthes biflora	9	5	5	Forb
STYPAT	Stylisma patens	17	12	5	Forb
SYMCON	Symphyotrichum concolor	4	0	0	Forb
TEPCHR_S	Tephrosia chrysophylla/spicata	27	15	0	Forb
TEPFLO	Tephrosia florida	17	0	6	Forb
VACARB	Vaccinium arboreum	15	0	1	Shrub
VACMYR	Vaccinium myrsinites	8	0	0	Shrub
YUCFIL	Yucca filamentosa	5	0	0	Shrub

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Additional Resources

For more information on the natural history and identification of the insects we found at Ordway, 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 Ordway, 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:
Poecilognathus punctipennus: Bob Peterson/BugGuide; *Physonocops*: Melissa McMasters, DiscoverLife; *Erynnis horiatus*: Mary Langlinais, BugGuide; *Junonia coenia*: James Campbell, Maryland biodiversity; *Acmaeodera pulchella*: Philip Harpootlian, BugGuide

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