

Creating Economically and Ecologically Sustainable Pollinator Habitat

District 2 Demonstration Research Project Summary

Updated for Site Visit in April 2019

The PIs are most appreciative for identification assistance provided by: Arian Farid and Alan R. Franck, Director and former Director, resp., University of South Florida Herbarium, Tampa, FL; Edwin Bridges, Botanical and Ecological Consultant; Floyd Griffith, Botanist; and Eugene Wofford, Director, University of Tennessee Herbarium, Knoxville, TN

Investigators

Rick Johnstone and Robin Haggie (IVM Partners, 501-C-3 non-profit; <http://www.ivmpartners.org/>); Larry Porter and John Nettles (ret.), District 2 Wildflower Coordinator; Jeff Norcini, FDOT State Wildflower Specialist

Cooperator

Rick Owen (Imperiled Butterflies of Florida Work Group – North)

Objective

Evaluate a cost-effective strategy for creating habitat for pollinators/beneficial insects in the ROW beyond the back-slope.

Rationale

- Will aid FDOT in developing a strategy to create pollinator habitat per the federal *BEE Act* and FDOT's Wildflower Program
- Will demonstrate that FDOT can simultaneously
 - Create sustainable pollinator habitat in an economical and ecological manner
 - Reduce mowing costs
- Part of national effort coordinated by IVM Partners, who has
 - Established or will establish similar projects on roadside or utility ROWS in Alabama, Arkansas, Maryland, New Mexico, Oklahoma, Idaho, Montana, Virginia, West Virginia, and Tennessee; studies previously conducted in Arizona, Delaware, Michigan, and New Jersey
 - Developed partnerships with US Fish & Wildlife Service, Army Corps of Engineers, US Geological Survey, New Jersey Institute of Technology, Rutgers University, Chesapeake Bay Foundation, Chesapeake Wildlife Heritage, The Navajo Nation, The Wildlife Habitat Council, The Pollinator Partnership, Progressive Solutions, Bayer Crop Sciences, Universities of Maryland, Ohio, West Virginia, and the EPA.

Potential Benefits

- Cost effective strategy for creating native pollinator habitat without expensive landscaping that could be evaluated and implemented statewide
- Pollination and beneficial insect services to ag crops adjacent to ROW
- Improved highway aesthetics
- Reduced mowing costs

Methods

Strategy to be Evaluated: Create habitat for pollinators/beneficial insects in the ROW area beyond the backslope by eliminating mowing (including fall cleanup mowing) and allowing germination of the seed bank, then selectively removing woody, invasive and undesirable species through periodic application of backpack directed herbicides.

In March 2016, three sites were selected by District 2 and clearly marked as such:

- **Site 1:** State Road 121; Raiford, Union County; approx. 3 miles north of SR-16; coordinates Lat. 30° 5' 8.98"N / Long. 82° 12' 57.19"W (30.085828, -82.215886)
Description (April 2016) – Moist soil; at wooded edge vegetation resembles a native community remnant, with a narrow transition area between remnant and >95% bahiagrass turf in remainder of site
- **Site 2:** State Road 25 (US-41); Lake City, Columbia County; approx. 10 miles north of Lake City / 3 miles south of Suwannee River; coordinates Lat. 30° 18' 52.54"N / Long. 82° 43' 0.39"W (30.31405, -82.71617)
Description (April 2016) – Mesic to upland; bahiagrass covered >95% of the area; most diversity was along and immediately adjacent to fence line
- **Site 3:** State Road 51 (US-41); Jasper, Hamilton County; approx. 15 miles north of Site 2; Coordinates Lat. 30° 27' 36.02"N / Long. 82° 53' 47.27"W (30.460056, -82.8964639)
Description (April 2016) – Mesic; more species diversity than Site 2

Services Provided by IVM Partners

- Baseline and restored vegetation surveys
- One selective herbicide application (via subcontractor, Progressive Solutions) – however, was not needed during 2016 to 2018

Services Provided by FDOT

- District 2: Site selection and delineation; take appropriate measures to prevent mowing of sites
- Jeff Norcini: Seasonal site visits and species monitoring

Project Status

- March 2016: Sites selected
- April 2016: Site visits conducted by J. Norcini and IVM Partners – overview survey and site descriptions conducted by J. Norcini; formal vegetation survey conducted by IVM Partners
- August 2016: At request of District 2 and IVM Partners, J. Norcini visited sites to determine which woody and undesirable species were to be sprayed; recommendations conveyed to IVM Partners and District 2
NOTE – Site 1 was accidentally mowed sometime in summer 2016, consequently herbicide treatments postponed
- October 2016: Site visits conducted by J. Norcini, R. Johnstone, and J. Nettles – overview survey and site status update
- February 2017: Site visits by IVM Partners noting that herbicide treatments not yet necessary
- April 2017: Site visits conducted by J. Norcini; met with J. Nettles at Site 2 to discuss project

- July to October 2017: Rick Owen, a member of the Imperiled Butterflies of Florida Work Group – North, conducted a baseline butterfly/invertebrate survey of all sites.
- August 2017: Site visits conducted by J. Norcini.
- October 2017: Site visits conducted by J. Norcini.
- February 2018: Site visits conducted by J. Norcini to evaluate cool season vegetation. Site visits by Rick Owen to conduct butterfly/invertebrate survey.
- April 2018: Site visits conducted by IVM Partners (all sites) and J. Norcini (Site 1; Site 2 – partial*; Site 3 – none*; *precluded by thunderstorms and heavy rain). Site visits by Rick Owen to conduct butterfly/invertebrate survey.
- August 2018: Site visits conducted by J. Norcini.
- October 2018: Site visits conducted by IVM Partners and J. Norcini; Workshop (Oct. 16 – Lake City Office and Site 2)
- February 2019: Site visits conducted by J. Norcini to evaluate cool season vegetation.
- April 2019: Site visits conducted by J. Norcini.

Results – General

1. April Site photos start on page 5; vegetation survey results start on page 8.
2. Results for the butterfly/invertebrate surveys conducted in 2017 by Rick Owen start on page 25.
3. Results for the butterfly/invertebrate surveys conducted on February 17, 2018 by Rick Owen
Definitely observed fewer species and lower abundances. Many typical grasshoppers seen in October last year were not seen, but lots of grasshoppers in nymph stage. American grasshopper was dominant insect. Few butterflies, bees, wasps, damselflies and dragonflies. No beetles.
4. Results for the butterfly/invertebrate surveys conducted on April 22, 2018 by Rick Owen
Sites were actually pretty busy with inverts yesterday, tons of grasshopper nymphs, bumble bees, wasps, dragonflies, and several butterfly species. The new sighting was at the Union County site, a fresh Delaware skipper. It was a beauty!
Lots of things were enjoying the *Salvia lyrata* including skippers. The bumble bees were all over the *Stachys floridana*. The *Oclemena reticulata* [right] at the union site was popular with the beetles!



5. Mowing Costs – Information provided by Kevin Couey, FDOT Contracts Manager, August 2017)

- Regular Large Machine Mowing: \$14.66 per acre
5 cycles x 1 acre@\$14.66 = \$73.30
- Large Herbicide Mowing: \$32.00 per acre
1 cycle x 1 acre@\$32.00 = \$32.00 per year
- Total cost per acre/year = \$105.30

Site 1 = 0.5 acres x 2 years no mowing x \$105.30 = \$105.30

Site 2 = 1 acre x 2 years no mowing x \$105.30 = \$210.60

Site 3 = 1 acre x 2 years no mowing x \$105.30 = \$210.60

Total cost savings = \$526.50 over 2 years; or \$210.60 per acre per year

Site 1 – SR 121, Union County



Site 2 – US 41, Columbia County



Site 3 – US 41, Hamilton County (April 2018 photo missing due to thunderstorms)



Site 1 – Updated for February 2019; species first observed in 2017, 2018, or 2019 are marked with asterisks.

Table 1. FDOT #1 NORTH Rte 121		30° 5' 8.98"N / 82° 12' 57.19"W (30.085828, -82.215886)		Year/month (blue = woody sp. presumed present)																	
Roadside, Raiford, Union Co., Florida				2016			2017			2018			2019			2020					
Trees/shrubs/herbs/VS/species		BASELINE	ITIS	Ap	Au	Oc	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc
Latin name		Common name	Code	VT	##																
<i>TREES – TLa, TLg & TS</i>																					
<i>Acer rubrum</i> L.		Red maple	ACRU	TLa							x*										
<i>Magnolia virginiana</i> L.		Sweetbay magnolia	MAVI2	TSa							x*	x									
<i>Pinus taeda</i> L.		Loblolly pine	PITA	TLg	x	x	x	x	x	x	x	x	x	x	x						
<i>Prunus (serotina)</i> Ehrh.		(Black) cherry	PRSE2		x						x	x									
<i>SHRUBS – SL & SS</i>																					
<i>Aronia arbutifolia</i> (L.) Pers.		Red chokeberry	ARAR7	SS						x*	x			x	x						
<i>Baccharis</i> sp. L.		Baccharis	BACCH	SS				x*	x	x	x		eradicated								
<i>Callicarpa americana</i> L.		American beautyberry	CAAM2	SL							x	x	x		x						
<i>Hypericum crux-andreae</i> (L.) Crantz		St. Peters-wort	HYCR3	SS	x			x	x	x	x	x		x	x						
<i>Hypericum hypericoides</i> (L.) Crantz		St. Andrew's-cross	HYHY	SS							x*	x		x	x						
<i>Ilex glabra</i> (L.) A. Gray		Inkberry holly	ILGL	SS							x*				x						
<i>Rubus cuneifolius</i> Pursh		Sand blackberry	RUCU	SS	x	x	x	x	x	x	x	x	x	x	x						
<i>Toxicodendron radicans</i> (L.) Kuntze		Eastern poison ivy	TORA2	SS	x			x		x											
<i>Vaccinium (corymbosum)</i> L.		(High bush) blueberry	VACO	SL	x						x										
<i>Vaccinium darrowii</i> Camp		Darrow's blueberry	VADA	SS	x																
<i>Vaccinium myrsinites</i> Lam.		Shiny blueberry	VAMY3	SS	x						x										
<i>WOODY VINES – armed</i>																					
<i>Smilax (bona-nox)</i> L.		(Saw) greenbrier	SMBO2	VW	x	x	x	x	x	x	x	x	x	x	x						
<i>Smilax (auriculata)</i> Walter		(Earleaf) greenbrier	SMILA2	VH							x*	x	x	x	x						
<i>WOODY VINES – unarmed</i>																					
<i>Gelsemium sempervirens</i> (L.) W.T. Aiton		Carolina jessamine	GESE	VW							x*	x	x		x	x					
<i>Vitis rotundifolia</i> Michx.		Muscadine	VIR03	VW				x*	x	x		x	x	x	x						

Table 1 – continued				2016			2017			2018				2019				2020				
				Ap	Au	Oc	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	
<i>HERBACEOUS – forbs</i>																						
<i>Acalypha gracilens</i> A. Gray	Slender threeseed mercury	ACGR2	HF										x*									
<i>Achillea millefolium</i> L.	Common yarrow	ACMI2	HF	x																		
<i>Agalinis</i> sp. Raf.	False foxglove	AGALI	HF			x																
<i>Allium canadense</i> L.	Meadow garlic	ALCA3	HF				x*				x				x							
<i>Bidens alba</i> (L.) DC.	Beggarticks; Spanish needles	BIAL	HF						x*				x	x	x							
<i>Buchnera americana</i>	American bluehearts	BUAM	HF					x*														
<i>Campanula floridana</i> S. Watson ex A. Gray	Florida bellflower	CAFL18	HF				x*				x											
<i>Cantinoa mutabilis</i> (Rich.) Harley & J.F.B. Pastore	Tropical bushmint	CAMU2	HF													x*						
<i>Carphephorus paniculatus</i> (J.F. Gmel.) Herb.	Hairy chaffhead	CAPA53	HF					x*	x			x	x									
<i>Cerastium glomeratum</i> Thuill.	Mouse-ear chickweed	CEGL2	HF	x																		
<i>Chaerophyllum tainturieri</i> Hook	Hairyfruit chervil	CHTA	HF															x*				
<i>Chaptalia tomentosa</i> Vent.	Pineland daisy	CHTO	HF	x														x				
<i>Cirsium horridulum</i> Michx.	Yellow thistle	(CIHO2)	HF	x			x		x	x	x	x	x	x	x							
<i>Conyza canadensis</i> (L.) Cronquist	Canadian horseweed	COCA5	HF					x*														
<i>Coreopsis</i> sp. L.	Tickseed	COREO2	HF	x																		
<i>Diodia virginiana</i> L.	Virginia buttonweed	DIVI3	HF					x*														
<i>Elephantopus</i> sp. L.	Elephantsfoot	ELEPH	HF	x	x	x	x	x	x			x	x									
<i>Erigeron quercifolius</i> L.	Oakleaf fleabane	ERQU	HF	x			x		x		x				x							
<i>Eryngium yuccifolium</i> Michx.	Button rattlesnakemaster	ERYU	HF										x*									
<i>Eupatorium capillifolium</i> (Lam.) Small	Dogfennel	EUCA5	HF		x	x		x	x			x	x		x							
<i>Eupatorium pilosum</i> Walter	Rough boneset	EUPI2	HF			x		x	x			x	x									
<i>Euphorbia (pubentissima)</i> Michx.	False flowering spurge	EUPU7	HF	x																		
<i>Galium tinctorium</i> L.	Stiff marsh bedstraw	GATIL	HF	x						x	x				x			x				
<i>Gamochaeta pensylvanica</i> (Willd.) Cabrera	Pennsylvania cudweed	GAPE2	HF	x			x				x				x			x				
<i>Geranium carolinianum</i> L.	Carolina geranium, Cranesbill	GECA5	HF	x			x			x	x				x			x				

Table 1 – continued				2016			2017			2018				2019				2020				
				Ap	Au	Oc	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	
<i>Helianthus radula</i> (Pursh) Torr. & A. Gray	Rayless sunflower	HERA	HF	x	x	x			x		x		x									
<i>Helianthus angustifolius</i> L.	Swamp sunflower	HEAN2	HF						x*				x									
<i>Hieracium</i> sp. L.	Hawkweed	HIERA	HF			x			x													
<i>Hydrocotyle verticillata</i> Thunb.	Whorled pennywort	HYVE2	HF								x*	x		x	x							
<i>Hypericum mutilum</i> L.	Dwarf St. Johnswort	HYMU	HF												x*							
<i>Hyptis alata</i> (Raf.) Shinnery	Clustered bushmint	HYAL	HF						x*				x									
<i>Krigia cespitosa</i> (Raf.) K.L. Chambers	Weedy dwarf dandelion	KRCA	HF	x			x				x				x							
<i>Lactuca graminifolia</i> Michx.	Grassleaf lettuce	LACTU	HF	x			x				x	x										
<i>Liatris</i> sp. Gaertn. ex Schreb.	Blazing star	LIATR	HF									x*										
<i>Lobelia glandulosa</i> Walter	Glade lobelia	LOGL	HF			x			x				x									
<i>Lobelia paludosa</i> Nutt.	White lobelia	LOPA3	HF				x*															
<i>Ludwigia</i> sp. L.	Primrosewillow	LUDWI	HF									x*	x									
<i>Lycopus</i> sp. L.	Waterhorehound	LYCOP4	HF								x*											
<i>Mitreola petiolata</i> (J. F. Gmel.) Torr. & A. Gray	Lax hornpod	MIPE3	HF					x*				x										
<i>Oclemena reticulata</i> (Pursh) G.L. Nesom (see Note 2a)	Whitetop aster	OCRE2	HF								x*											
<i>Oenothera (simulans)</i> (Small)W.L. Wagner & Hoch	(Southern) beeblossom	OESI	HF	x																		
<i>Oxalis corniculata</i> L.	Common yellow woodsorrel	OXCO	HF	x			x			x	x			x	x							
<i>Phyllanthus urinaria</i> L.	Chamberbitter	PHUR	HF	x	x	x		x	x			x	x									
<i>Physostegia (leptophylla)</i> Small	(Slender) false dragonhead	PHLE9	HF					x*														
<i>Pityopsis (graminifolia)</i> (Michx.) Nutt.	(Narrowleaf silkgrass)	PIGR4	HF	x	x	x			x				x									
<i>Plantago virginica</i> L.	Virginia plantain	PLVI	HF				x*				x											
<i>Polygala nana</i> (Michx.) DC.	Candyroot	PONA2	HF	x																		
<i>Portulaca</i> sp. L.	Purslane	PORTU	HF	x																		
<i>Pterocaulon pycnostachyum</i> (Michx.) Elliott	Blackroot	PTPY2	HF					x*			x				x							
<i>Pyrrhopappus carolinianus</i> (Walter) DC.	Carolina desertchicory	PYCA2	HF							x	x											

Table 1 – continued				2016			2017			2018				2019			2020					
				Ap	Au	Oc	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	
<i>Rhexia mariana</i> L.	Pale meadowbeauty	RHMA	HF		x	x		x				x	x									
<i>Rumex hastatulus</i> Baldw.	Heart-wing sorrel	RUHA2	HF	x																		
<i>Salvia lyrata</i> L.	Lyreleaf sage	SALY2	HF	x			x			x	x	x			x							
<i>Scutellaria integrifolia</i> L.	Helmet-flowered skullcap	SCIN2	HF	x							x		x	x	x							
<i>Sisyrinchium (angustifolium)</i> Mill. or <i>Sisyrinchium (nashii)</i> E.P. Bicknell	(Narrowleaf) blue-eyed grass (Nash's) blue-eyed grass	SIAN3 SINA	HF	x			x				x				x	x						
<i>Solidago canadensis</i> L.	Canada goldenrod	SOCA6	HF						x*		x	x	x		x							
<i>Solidago stricta</i> Aiton	Wand goldenrod	SOST	HF			x							x									
<i>Spermolepis (divaricata)</i> (Walter) Raf. ex Ser.	(Rough fruit) scale seed	SPDI2	HF	x																		
<i>Stachys floridana</i> Shuttlw. ex Benth.	Florida betony	STFL4	HF	x			x			x	x			x	x							
<i>Valerianella radiata</i> (L.) Dufr.	Beaked cornsalad	VARA	HF				x*				x											
<i>Symphotrichum</i> sp. Nees	Aster	SYMPH4	HF										x*									
<i>Veronica</i> sp. L.	Speedwell	VERON	HF	x																		
<i>Viola</i> sp. L.	Violet	VIOLA	HF	x						x					x							
<i>Xyris</i> sp. L.	Yellow-eyed grass	XYRIS	HF		x	x						x										
<i>Youngia japonica</i> (L.) DC.	Oriental False Hawksbeard	YOJAE	HF												x*							
<i>Zephyranthes atamasca</i> (L.) Herb.	Atamasco lily	ZEAT	HF								x*											
<i>HERBACEOUS – Fabaceae</i>																						
<i>Chamaecrista fasciculata</i> (Michx.) Greene	Partridge pea	CHFA2	HFf		x	x		x				x	x									
<i>Desmodium incanum</i> DC.	Zarabacoa comun	DEIN#	HFf												x*							
<i>Medicago lupulina</i> L.	Black medick	MELU	HFf													x*						
<i>Trifolium campestre</i> Schreb.	Hop clover	TRCA5	HFf	x			x			x	x					x						
<i>Trifolium repens</i> L.	White clover	TRRE3	HFf	x			x			x	x		x			x						
<i>Vicia</i> sp. L.	Vetch	VICIA	HFf							x*	x				x	x						
<i>HERBACEOUS – vines</i>																						
<i>Bignonia sempervirens</i> L.	Trumpet honeysuckle	BISE3	VH								x*											
<i>Centrosema virginianum</i> (L.) Benth.	Spurred butterfly pea	CEVI2	VH					x*														

Table 1 – continued				2016			2017			2018			2019			2020						
				Ap	Au	Oc	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	
<i>GRASSES – graminoid MOs</i>																						
<i>(Agrostis sp.)</i> L.	(Bentgrass)	AGROS2	GR																		x*	
<i>Andropogon glomeratus</i> (Walter) Britton, Sterns & Poggenb.	Bushy bluestem	ANGL2	GR			x		x	x		x	x	x								x	
<i>Andropogon virginicus</i> L.	Broomsedge bluestem	ANVI2	GR	x	x	x	x		x	x	x	x	x								x	
<i>Briza minor</i> L.	Little quakinggrass	BRMI2	GR	x																	x	
<i>Coleataenia anceps</i> (Michx.) Soreng	Beaked panicum	COAn2	GR						x*							x						
<i>Eragrostis</i> sp. von Wolf	Lovegrass	ERAGR	GR			x			x		x											
<i>Dichanthelium</i> sp. (Hitchc. & Chase) Gould	Rosette or deer tongue grass	DICHA2	GR	x																	x	
<i>Paspalum notatum</i> Flueggé	Bahiagrass	PANO2	GR	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
<i>Paspalum urvillei</i> Steud.	Vaseygrass	PAUR2	GR			x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	
<i>Setaria</i> sp. P. Beauv.	Foxtail	SETAR	GR		x	x		x	x						x	x						
<i>Sphenopholis obtusata</i> (Michx.) Scribn.	Prairie wedgescale	SPOB	GR									x*									x	
<i>Tripsacum dactyloides</i> (L.) L.	Eastern gamagrass	TRDA3	GR											x*	x							
<i>RUSHES & SEDGES</i>																						
<i>Cyperus esculentus</i> L.	Yellow nutsedge	CYES	SG	x				x				x						x	x			
<i>Scleria reticularis</i> Michx.	Netted nutrush	SCRE	SG											x*	x						x	
Total all sp. #				45	20	26	29	28	32	25	52	40	42	32	49							

Created May 2019 based on list updated for April 2019 survey																			
		2016			2017			2018					2019			2020			
		Apr	Aug	Oct	Apr	Aug	Oct	Feb	Apr	Aug	Oct	Feb	Apr	Aug	Oct	Feb	Apr	Aug	Oct
Native	91	35	18	23	25	25	29	19	44	38	39	26	40						
NonNative	13	8	2	3	4	3	3	4	7	2	3	5	8						
Unknown nativity	3	2	0	0	0	0	0	2	1	0	0	1	1						
Total	107	45	20	26	29	28	32	25	52	40	42	32	49	0	0	0	0	0	0

TABLE NOTES – Site 1

1. Species observed not based on a formal survey; does not include “standing dead” (like brown shoots of native grasses).
2. Species in bold font were observed only by J. Norcini; all others were observed by J. Norcini and R. Haggie/R. Johnstone.

OBSERVATIONS – Site 1

February 2019

1. Many green broadleaf seedlings (or emerging perennials) toward wooded edge
2. *Trifolium repens* widespread and abundant in mowed area but none observed in un-mowed area
3. Bahiagrass dense; starting to green up
4. *Paspalum urvillei* – mainly in lowest area of ROW, and running parallel to road (see photo on right)
5. Flowering – *Aronia* (widespread); limited – *Scutellaria*, *Sisyrinchium*, *Galium*
6. 2 new species, both non-native
7. No *Baccharis* near road; a few *Pinus* seedlings in unmowed area may need to be eradicated

April 2019

1. Deleted *Sorghum halepense* from list; no further observations to support its presence
2. *Scutellaria* widespread, especially in southern 2/3s
3. 4 new species, 3 of which are native



Site 2 – Updated for April 2019; species first observed in 2017, 2018 or 2019 are marked with asterisks.

Table 2. FDOT #2, BAHIA plot, US 41		30° 18' 52.54"N / 82° 43' 4"W (30.31405, -82.71617)		Year/month (blue = woody sp. presumed present)																		
BAHIA plot, Columbia County, Florida (south of White Springs, which is in Hamilton County)				2016			2017			2018			2019			2020						
Trees/shrubs/herbs/VS/species		ITIS		Ap	Au	Oc	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	
Latin name		Common name		Code	VT	##																
<i>TREES – TLa, TLg & TS</i>																						
<i>Diospyros virginiana</i> L.		Common persimmon		DIVI5	TLa	x	x	x	x	x			x	x								
<i>Quercus (nigra)</i> L.		(Water) oak		QUNI	TLa					x*	x	x	x	Erad.								
<i>Quercus virginiana</i> L.		Live oak		QUERC	TLa	x	x	x	x	x	x	x	x	Erad.								
<i>(Prunus angustifolia)</i> Marshall		(Chickasaw plum)		PRAN3	TSa					x*			x									
<i>Rhus copallinum</i> L.		Winged sumac		RHUS	TSa				x*	x	x			x	x	x	x					
<i>SHRUBS – SL & SS</i>																						
<i>Asimina incana</i> (W. Bartram) Exell		Wooly pawpaw		ASIN12	SS		x	x	x	x							x					
<i>Asimina angustifolia</i> Raf.		Slimleaf pawpaw		ASAN6	SS		x	x	x	x			x	x			x					
<i>Hypericum</i> sp.		St. Johnswort		HYPHER	SS								x*									
<i>Rubus cuneifolius</i> Pursh		Sand blackberry		RUCU	SS		x	x	x	x	x	x	x	x	x			x	x			
<i>Serenoa repens</i> (W. Bartram) Small		Saw palmetto		SERE2	SS		x	x	x	x	x	x					x	x				
<i>Vaccinium stamineum</i> L.		Deerberry		VAST	SS				x*	x	x			x	x	x						
<i>WOODY VINES – armed</i>																						
<i>Rubus pensilvanicus</i> Poir. or <i>Rubus trivalis</i> Michx.		Sawtooth dewberry Southern dewberry		RUPE5 RUTR	VW	x																
<i>Smilax</i> sp. L.		Greenbrier		SMILA2	VW	x				x				x	x	x	x					
<i>WOODY VINES – unarmed</i>																						
<i>Vitis</i> sp. L.		Grape		VITIS	VW				x*	x												

Table 2 – continued				2016			2017			2018			2019			2020					
				Ap	Au	Oc	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc
<i>HERBACEOUS – forbs</i>																					
<i>Ambrosia artemisiifolia</i> L.	Common ragweed	AMAR2	HF	x	x	x		x	x		x	x	x		x						
<i>Bidens alba</i> (L.) DC.	Beggarticks; Spanish needles	BIAL	HF									x*	x								
<i>Cantinoa mutabilis</i> (Rich.) Harley & J.F.B. Pastore	Tropical bushmint	CAMU2	HF						x*	x	x	x	x								
<i>Cnidoscolus stimulosus</i> (Michx.) Engelm. & A. Gray	Tread softly	CNURS	HF	x	x	x	x	x	x			x	x		x						
<i>Conyza canadensis</i> (L.) Cronquist	Canadian horseweed	COCA5	HF			x			x			x	x								
<i>Coreopsis basalis</i> (A. Dietr.) S.F. Blake	Goldenmane tickseed	COBA2	HF	x			x			x	x	x		x	x						
<i>Crocanthemum corymbosum</i> (Michx.) Britton	Pinebarren frostweed	CRCO28	HF						x*			x	x		x						
<i>Crocanthemum (nashii)</i> (Britton) Barnhart	(Florida scrub) frostweed	CRNA3	HF												x*						
<i>Coreopsis lanceolata</i> L.	Lanceleaf tickseed	COLA	HF										x*	x							
<i>Corydalis micrantha</i> (Engelm.ex A. Gray) A. Gray subsp. australis (Chapm.) G.B. Ownbey	Smallflower Fumewort	COMIA2	HF												x*						
<i>Croptilon divaricatum</i> (Nutt.) Raf.	Slender scratchdaisy	CRDI17	HF			x							x								
<i>Croton glandulosus var. septentrionalis</i> Müll. Arg.	Vente conmigo	CRGLS	HF		x								x								
<i>Descurainia pinnata</i> (Walter) Britton	Western tansymustard	DEPI	HF				x*				x				x						
<i>Diodia virginiana</i> L.	Virginia buttonweed	DIVI3	HF									x*	x								
<i>Elephantopus elatus</i> Bertol. or <i>Elephantopus nudatus</i> A. Gray	Tall elephantsfoot Smooth elephantsfoot	ELEL3 ELNU	HF									x*	x		x						
<i>Erigeron sp.</i> L.	Fleabane	ERIGE2	HF		x			x	x			x			x						
<i>Eupatorium capillifolium</i> (Lam.) Small	Dogfennel	EUCA5	HF		x	x	x	x	x			x	x	x	x						
<i>Eupatorium compositifolium</i> Walter	Yankeeweed	EUCO7	HF						x*			x	x		x						
<i>Froelichia floridana</i> (Nutt.) Moq.	Cottonweed	FRFL	HF		x	x			x			x	x								

Table 2 – continued				2016			2017			2018			2019			2020						
				Ap	Au	Oc	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	
<i>Krigia virginica</i> (L.) Willd.	Virginia dwarfdandelion	KRVI	HF	x											x							
<i>Euthamia caroliniana</i> (L.) Greene ex Porter & Britton	Slender flattop goldenrod	EUCA26	HF										x*									
<i>Galium</i> sp. L.	Bedstraw	GALIU	HF	x																		
<i>Krigia virginica</i> (L.) Willd.	Virginia dwarfdandelion	KRVI	HF	x											x							
<i>Lactuca (graminifolia)</i> Michx.	(Grassleaf) lettuce	LACTU	HF	x							x	x		x	x							
<i>Lepidium virginicum</i> L.	Virginia pepperweed	LEVI3	HF												x*							
<i>Ludwigia (maritima)</i> Harper	(Seaside) primrosewillow	LUMA4	HF		x			x														
<i>Ludwigia suffruticosa</i> Walter	Shrubby primrosewillow	LUSU11	HF		x			x	x			x	x									
<i>Monarda punctata</i> L.	Spotted beebalm	MOPU	HF	x	x	x			x				x									
<i>Oenothera biennis</i> L.	Cutleaf eveningprimrose	OEBI	HF	x	x							x										
<i>Oenothera (simulans)</i> (Small)W.L. Wagner & Hoch	(Southern beeblossom)	OESI	HF	x				x				x										
<i>Opuntia austrina</i> Small	Devil's-tongue	OPAU3	HF	x	x	x		x	x		x		x	x	x	x						
<i>Oxalis</i> sp. L.	Woodsorrel	OXCO	HF	x				x	x	x	x		x	x	x	x						
<i>Paronychia americana</i>	American nailwort	PAAM3	HF									x*	x									
<i>Penstemon multiflorus</i> Chapm. ex Benth.	Manyflower beardtongue	PEMU9	HF		x			x	x	x		x	x	x								
<i>Phlox drummondii</i> Hook.	Drummond phlox	PHDR	HF	x			x	x		x	x	x		x	x							
<i>Physalis arenicola</i> Kearney	Cypresshead groundcherry	PHAR14	HF		x	x	x	x	x			x	x	x	x							
<i>Piriqueta cissoids</i> (L.) Grebe.	Pitted stripeeed	PICI	HF	x	x		x					x										
<i>Pityopsis graminifolia</i> (Michx.) Nutt.	Narrowleaf silkgrass	PIGR4	HF	x	x	x	x	x	x			x	x	x								
<i>Plantago</i> sp. L.	Plantain	PLANT	HF	x																		
<i>Pseudognaphalium obtusifolium</i> (L.) Hilliard & B.L. Burt	Rabbit tobacco	PSOB3	HF			x			x			x			x							

Table 2 – continued				2016			2017			2018			2019			2020					
				Ap	Au	Oc	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc
<i>Pyrhopappus carolinianus</i> (Walter) DC.	Carolina desertchicory	PYCA2	HF	x																	
<i>Rhexia mariana</i> L.	Pale meadowbeauty	RHMA	HF									x*									
<i>Richardia brasiliensis</i> Gomes and/or <i>Richardia scabra</i> L.	Tropical Mexican clover Rough Mexican clover	RIBR2 RISC	HF	x	x			x	x			x	x								
<i>Rumex hastatulus</i> Baldw.	Heartwing dock	RUHA2	HF	x			x			x	x			x	x						
<i>Salvia lyrata</i> L.	Lyreleaf sage	SALY2	HF	x																	
<i>Spermolepis (divaricata)</i> (Walter) Raf. ex Ser.	(Rough fruit) scaleseed	SPDI2	HF	x											x						
<i>Symphotrichum</i> sp. Nees	Aster	SYMPH4	HF									x*									
<i>Tradescantia ohiensis</i> Raf.	Ohio spiderwort	TROH	HF											x*							
<i>Trichostema dichotomum</i> L.	Forked bluecurls	TRID2	HF						x*				x								
<i>Triodanis perfoliata</i> (L.) Nieuwl.	Clasping Venus' looking-glass	TRPE4	HF								x				x						
<i>Verbena officinalis</i> subsp. <i>halei</i> (Small) Barber	Texas vervain	VEOFH	HF		x							x									
<i>Wahlenbergia marginata</i> (Thunb.) A. DC.	Southern rockbell	WAMA	HF		x			x				x									
<i>HERBACEOUS – Fabaceae</i>																					
<i>Chamaecrista fasciculata</i> (Michx.) Greene	Partridge pea	CHFA2	HFf		x	x		x	x			x									
(<i>Desmodium</i> sp. Desv.)	(Ticktrefoil)	DESMO	HFf	x							x	x									
<i>Indigofera hirsuta</i> L.	Hairy indigo	INHI	HFf						x*		x	x	x								
<i>Lespedeza angustifolia</i> (Pursh) Elliott	Narrowleaf lespedeza	LEAN	HFf					x*	x				x								
<i>Lespedeza hirta</i> (L.) Hornem.	Hairy lespedeza	LEHI2	HFf					x*	x			x	x		x						
<i>Macroptilium lathyroides</i> (L.) Urb.	Wild bushbean	MALA9	HFf									x*									
<i>Zornia bracteata</i> J.F. Gmel.	Viperina	ZOBR	HFf					x*													

Table 2 – continued				2016			2017			2018			2019			2020					
				Ap	Au	Oc	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc
<i>HERBACEOUS VINES</i>																					
<i>Ipomoea sp.</i> L. (white flowers)	Morning-glory	IPAL	VH				x*					x									
<i>Passiflora incarnata</i> L.	Purple passionflower	PAIN6	VH				x*					x									
<i>Mimosa quadrivalvis</i> L.	Sensitive brier	MIQU2	VH				x*														
<i>GRASSES – graminoid MOs</i>																					
<i>Andropogon virginicus</i> L.	Broomsedge bluestem	ANVI2	GR		x	x	x	x	x	x	x	x									
<i>Andropogon L. virginicus var. glaucus</i> Hack.	Chalky bluestem	ANVIG2	GR				x*	x	x			x	x		x						
<i>Cynodon dactylon</i> (L.) Pers.	Bermudagrass	CYDA	GR										x*								
<i>Paspalum notatum</i> Flueggé	Bahiagrass	PANO2	GR	x	x	x	x	x	x	x	x	x	x	x							
<i>Paspalum urvillei</i> Steud.	Vaseygrass	PAUR2	GR		x	x			x			x	x	x							
<i>Piptochaetium avenaceum</i> (L.) Parodi	Blackseed needlegrass	PIAV	GR				x*							x	x						
<i>RUSHES & SEDGES</i>																					
<i>Carex (longii)</i> Mack.	(Long's sedge)	CALO5	SG												x*						
<i>Cyperus ovatus</i> Baldw.	Pinebarren flatsedge	CYOV3	SG					x*		x		x									
<i>Juncus sp.</i> L.	Rush	JUNCU	RJ	x																	
Total all sp. #					85																

Created May 2019 based on list updated for April 2019 survey																			
		2016			2017			2018					2019			2020			
		Apr	Aug	Oct	Apr	Aug	Oct	Feb	Apr	Aug	Oct	Feb	Apr	Aug	Oct	Feb	Apr	Aug	Oct
Native	75	25	22	20	18	32	31	15	17	43	36	17	33						
NonNative	10	3	4	1	2	4	5	3	6	9	6	2	2						
Unknown nativity	0	0	0	0	0	0	0	2	0	0	0	0	0						
Total	85	28	26	21	20	36	36	20	23	52	42	19	35						

TABLE NOTES – Site 2

1. Species observed not based on a formal survey; does not include “standing dead” (like brown shoots of native grasses).
2. Species in bold font were observed only by J. Norcini; all others were observed by J. Norcini and R. Haggie/R. Johnstone.

OBSERVATIONS – Site 2

February 2019

1. At least one *Quercus* was cut back
2. Locally abundant seedlings/perennials emerging
3. Bahiagrass dense
4. *Oxalis* mainly in southeast corner that had been mowed previously, much of that blooming; southeast corner much more open canopy allowing broadleaves to develop faster
5. 2 new species, both native
6. *Corydalis* (new species) was blooming

April 2019

1. *Asimina angustifolia* – much more widespread
2. 3 new species, all native
3. All *Quercus* cut back

Site 3 – Updated for April 2019; species first observed in 2017, 2018 or 2019 are marked with asterisks.

Table 3. FDOT #3 HOP CLOVER plot, US 41		30° 27' 37"N/82° 53' 49"W (30.4600056, -82.8964639)		Year/month (blue = woody sp. presumed present)																		
Hop clover TRCA5 plot, Jasper, Hamilton County, Florida				2016			2017			2018			2019			2020						
Trees/shrubs/herbs/VS/species		BASELINE	ITIS	Ap	Au	Oc	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	
Latin name		Common name	Code	VT	##																	
<i>TREES – TLa, TLg & TS</i>																						
<i>SHRUBS – SL & SS</i>																						
<i>Hypericum sp. L.</i>		St. Johnswort	HYPER	SS			x*					x										
<i>Lyonia fruticosa</i> (Michx.) G.S. Torr.		Coastal plain staggerbush	LYFR3	SS			x*	x	x	x				x	x							
<i>Rubus cuneifolius</i> Pursh		Sand blackberry	RUCU	SS	x	x		x	x	x		x	x	x	x							
<i>Sabal etonia</i> Swingle ex Nash or <i>Serenoa repens</i> (W. Bartram) Small		Scrub palmetto OR Saw palmetto	SAET SERE2	PA							x*											
<i>Toxicodendron (pubescens)</i> Mill. or <i>Toxicodendron (radicans)</i> (L.) Kuntze		(Atlantic) poison oak (Eastern) poison ivy	TOPU2 TORA2	SS	x																	
<i>WOODY VINES – armed</i>																						
<i>Rubus (pensilvanicus)</i> Poir. or <i>Rubus (trivialis)</i> Michx.		(Sawtooth) dewberry (Southern) dewberry	RUPE5 RUTR	VW	x					x	x	x	x					x				
<i>WOODY VINES – unarmed</i>																						
<i>(Campsis radicans)</i> (L.) Seem. ex Bureau or <i>(Ampelopsis arborea)</i> (L.) Koehne		(Trumpet creeper) (Peppervine)	CARA2 AMAR5	VW			x*		x			x			x							
<i>HERBACEOUS – forbs</i>																						
<i>Acalypha gracilens</i> A. Gray		Slender threeseed mercury	ACGR2	HF					x*			x	x									
<i>Agalinis sp.</i> Raf.		False foxglove	AGALI	HF			x						x									
<i>Allium canadense</i> L.		Meadow garlic	ALCA3	HF	x			x		x	x			x	x							
<i>Ambrosia artemisiifolia</i> L.		Common ragweed	AMAR2	HF		x	x	x	x			x	x									
<i>Artemisia vulgaris</i> L.		Mugwort; wormwood	ARVU	HF									x*		x							

Table 3 – continued				2016			2017			2018			2019			2020						
				Ap	Au	Oc	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	
<i>Bidens pilosa</i> L.	Spanish needles	BIPI	HF										x*									
<i>Buchnera americana</i> L.	American bluehearts	BUAM	HF		x			x				x										
<i>Cantinoa mutabilis</i> (Rich.) Harley & J.F.B. Pastore	Tropical bushmint	CAMU2	HF										x*									
<i>Cerastium (glomeratum)</i> Thuill.	(Sticky) mouse-eared chickweed	CEGL2	HF	x																		
<i>Cirsium horridulum</i> Michx.	Purple or Scottish thistle	CIHO2	HF	x			x	x	x	x	x			x	x							
<i>Conyza canadensis</i> (L.) Cronquist	Canadian horseweed	COCA5	HF			x	x	x	x	x		x	x									
<i>Coreopsis basalis</i> (A. Dietr.) S.F. Blake	Goldenmane tickseed	COBA2	HF	x			x															
<i>Diodia virginiana</i> L.	Virginia buttonweed	DIVI3	HF					x*				x										
<i>Erigeron quercifolius</i> Lam.	Oakleaf fleabane	ERQU	HF	x	x			x				x										
<i>Eupatorium capillifolium</i> (Lam.) Small	Dogfennel	EUCA5	HF				x*	x	x			x	x		x							
<i>Eupatorium</i> sp. L.	Thoroughwort	EUPAT	HF									x*	x		x							
<i>Euthamia caroliniana</i> (L.) Greene ex Porter & Britton	Slender flattop goldenrod	EUCA26	HF						x*				x									
<i>Galium tinctorium</i> L.	Stiff marsh bedstraw	GATIL	HF												x*							
<i>Gamochaeta</i> sp. Weddell	Cudweed	GAMOC	HF	x																		
<i>Geranium carolinianum</i> L.	Carolina geranium, Cranesbill	GECA5	HF	x						x	x			x								
<i>Helianthus angustifolius</i> L.	Swamp sunflower	HEAN2	HF					x*	x			x	x									
<i>Heterotheca subaxillaris</i> (Lam.) Britton & Rusby	Camphorweed	HESU3	HF		x	x		x	x	x		x	x	x								
<i>Hydrocotyle</i> sp. L.	Pennywort, dollarweed	HYDRO2	HF									x*										
<i>Hyptis alata</i> (Raf.) Shinnery	Clustered bushmint	HYAL	HF										x*									
<i>Krigia virginica</i> (L.) Willd.	Virginia dwarf dandelion	KRVI	HF	x																		
<i>Lactuca graminifolia</i> Michx.	Grassleaf lettuce	LAGR	HF	x							x	x		x	x							
<i>Ludwigia maritima</i> Harper	Seaside primrosewillow	LUMA4	HF		x			x				x										
<i>Monarda punctata</i> L.	Spotted beebalm	MOPU	HF		x							x										
<i>Nuttallanthus canadensis</i> (L.) D.A. Sutton	Canada toadflax	NUCA	HF												x*							
<i>Oenothera biennis</i> L.	Common eveningprimrose	OEBI	HF										x*		x							
<i>Oenothera (simulans)</i> (Small)W.L. Wagner & Hoch	(Southern beeblossom)	OESI	HF		x						x	x										
<i>Oxalis corniculata</i> L.	Common yellow woodsorrel	OXCO	HF										x*									
<i>Plantago major</i> L.	Common plantain	PLMA2	HF	x							x											

Table 3 – continued			2016			2017			2018			2019			2020						
			Ap	Au	Oc	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	
<i>Phyla nodiflora</i> (L.) Greene	Fog fruit	PHNO2	HF				x*				x										
<i>Plantago</i> sp. L.	Plantain	PLANT	HF	x																	
<i>Pseudognaphalium obtusifolium</i> (L.) Hilliard & B.L. Burtt	Rabbit tobacco	PSOB3	HF			x															
<i>Pyrrhopappus carolinianus</i> (Walter) DC.	Carolina desertchicory	PYCA2	HF	x										x							
<i>Rhexia mariana</i> L.	Pale meadowbeauty	RHMA	HF		x			x			x	x									
<i>Rumex hastatulus</i> Baldw.	Heartwing dock	RUHA2	HF	x						x				x							
<i>Salvia lyrata</i> L.	Lyreleaf sage	SALY2	HF	x			x			x				x							
<i>Sisyrinchium (angustifolium)</i> Mill. or <i>Sisyrinchium (nashii)</i> E.P. Bicknell	(Narrowleaf) blue-eyed grass (Nash's) blue-eyed grass	SIAN3 SINA	HF	x						x											
<i>Solidago canadensis</i> . L.	Canada goldenrod	SOCA6	HF			x		x		x	x	x		x							
<i>Spermolepis</i> sp. Raff.	Scaleseed	SPERM2	HF	x			x			x											
<i>Stachys floridana</i> Shuttlw. ex Benth.	Florida betony	STFL4	HF	x			x	x	x	x		x	x	x							
<i>Symphotrichum (dumosum)</i> (L.) G.L. Nesom	(Button) aster	SYDU2	HF	x		x		x				x									
<i>Tradescantia ohiensis</i> Raf.	Ohio spiderwort	TROH	HF	x			x	x	x	x	x	x	x	x							
<i>Trichostema dichotomum</i> L.	Forked bluecurls	TRID2	HF					x*													
<i>Triodanis perfoliata</i> (L.) Nieuwl	Venus' looking-glass	TRPE4	HF																	x*	
<i>Valerianella radiata</i> (L.) Dufr.	Beaked cornsalad	VARA	HF				x*														
<i>Verbena brasiliensis</i> Vell.	Brazilian vervain	VEBR2	HF	x	x	x	x	x	x	x	x	x		x							
<i>Viola</i> sp. L.	Violet	VIOLA	HF							x				x							
<i>Wahlenbergia marginata</i> (Thunb.) A. DC.	Southern rockbell	WAMA	HF			x		x						x							
HERBACEOUS – Fabaceae																					
<i>Chamaecrista fasciculata</i> (Michx.) Greene	Partridge pea	CHFA2	HFf									x*									
<i>Crotalaria lanceolata</i> E. Mey.	Lanceleaf rattlebox	CRLA7	HFf		x							x	x								
<i>Indigofera hirsuta</i> L.	Hairy indigo	INHI	HFf			x		x				x	x								
<i>Desmodium paniculatum</i> (L.) DC.	Panicled ticktrefoil	DEPA6	HFf					x*	x			x	?								
<i>Desmodium tortuosum</i> (Sw.) DC.	Dixie ticktrefoil	DETO	HFf					x*				x	?								
<i>Lespedeza hirta</i> (L.) Hornem.	Hairy lespedeza	LEHI2	HFf		x			x													
<i>Trifolium campestre</i> Schreb.	Hop clover	TRCA5	HFf	x			x			x				x							

Table 3 – continued				2016			2017			2018			2019			2020						
				Ap	Au	Oc	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	Fb	Ap	Au	Oc	
<i>Vicia</i> sp. L.	Vetch	VICIA	HFf	x						x	x			x	x							
<i>Vicia tetrasperma</i> (L.) Schreb.	Lentil vetch	VITE	HFf												x*							
HERBACEOUS VINES																						
<i>Ipomoea cordatotriloba</i> Dennst.	Tievine	IPCO8	VH						x*			x	x									
<i>Ipomoea hederifolia</i> L.	Scarletcreeper	IPHE2	VH			x			x				x									
<i>Ipomoea</i> sp. L. (white flowers)	Morning-glory	IPAL	VH					x*														
GRASSES – graminoid MOs																						
<i>(Amphicarpum muehlenbergianum)</i> (Schult.) Hitchc.	(Blue maidencane)	AMMU2	GR						x*			x	x									
<i>Andropogon glomeratus</i> (Walter) Britton, Sterns & Poggenb.	Bushy bluestem	ANGL2	GR			x		x	x		x	x	x						x			
<i>Andropogon virginicus</i> L.	Broomsedge bluestem	ANVI2	GR	x	x	x		x	x	x	x	x	x						x			
<i>Festuca</i> sp. L.	Fescue	FESTU	GR																x*			
<i>Lolium arundinaceum</i> (Schreb.) Darbysh.	Tall fescue	SCAR7	GR									x*										
<i>Paspalum notatum</i> Flueggé	Bahiagrass	PANO2	GR	x	x	x	x	x	x	x	x	x	x	x	x				x			
<i>Paspalum urvillei</i> Steud.	Vaseygrass	PAUR2	GR						x*	x	x	x	x						x			
<i>Sphenopholis obtusata</i> (Michx.) Scribn.	Prairie wedgescale	SPOB	GR																x*			
RUSHES & SEDGES																						
<i>Carex (muehlenbergii)</i> Schkuhr ex Willd.	Muhlenberg's sedge	CAMU4	SG																x*			
<i>Cyperus</i> sp. 1 L.	Flatsedge	CYPER	SG					x*				x	x						?			
<i>Cyperus</i> sp. 2 L.	Flatsedge	CYPER	SG					x*				x	x						?			
<i>Rhynchospora (baldwinii)</i>	Beaksedge (Baldwin's)	RHBA	SG																x*			
<i>Rhynchospora colorata</i> (L.) H. Pfeiffer	Starrush whitetop	RHCO7	SG										x*	x								
Total all sp. #				26	16	16	19	26	28	16	25	39	35	12	35							

Created May 2019 based on list updated for April 2019 survey																			
		2016			2017			2018			2019			2020					
		Apr	Aug	Oct	Apr	Aug	Oct	Feb	Apr	Aug	Oct	Feb	Apr	Aug	Oct	Feb	Apr	Aug	Oct
Native	70	19	12	12	16	23	23	13	19	34	30	11	27						
NonNative	11	6	3	4	3	3	5	3	6	5	5	1	8						
Unknown nativity	2	1	1	0	0	0	0	0	0	0	0	0	0						
Total	83	26	16	16	19	26	28	16	25	39	35	12	35	0	0	0	0	0	0

TABLE NOTES – Site 3

1. Species observed not based on a formal survey; does not include “standing dead” (like brown shoots of native grasses).
2. Species in bold font were observed only by J. Norcini; all others were observed by J. Norcini and R. Haggie/R. Johnstone.

OBSERVATIONS – Site 3

February 2019

1. 12 species (no new ones observed) – At least 10 native; *Vicia* probably non-native but not blooming so could not ID
2. Like 2018, *Stachys* was widespread, locally abundant, and clearly the dominant species; *Allium canadense*, was locally abundant in the demo area as well in the mowed area
3. Bahiagrass dense; beginning to green up
4. There was a dead deer along edge of demo plot; probably a deer-vehicle collision
5. *Lyonia* was blooming

April 2019

1. Deleted *Sorghum halepense* from list; no further observations to support its presence
2. Dead deer has been removed
3. 8 new species, 6 of which are native

An invertebrate comparison among three Florida Department of Transportation roadside easements: Hamilton, Columbia and Union County, Florida in 2017.

By Richard Owen
15 January 2018



Southern red-legged grasshopper, *Melanoplus propinquus*
Columbia County, Florida 19 October 2017



Common long-horned bee, *Melissodes communis*
Columbia County, Florida 12 August 2017



Hamilton County, Florida 12 August 2017



Hanging thief, *Diogmites esiriens*
Union County, Florida 5 July 2017



Barred yellow, *Eurema daira*
Union County, Florida 19 October 2017

INTRODUCTION

The objective of this work was to conduct invertebrate surveys at three Florida Department of Transportation (FDOT) roadside study sites.

METHODS

Study sites

There were three different roadside study sites chosen for this work, one site in each of the three counties, including Hamilton, Union, and Columbia. In general, each study site had very unique habitat characteristics, but the most similar attribute was that each site was located immediately adjacent to a fairly busy state highway. The available survey area of the Union site was the smallest (ca. 0.6 ac), Columbia site was second largest (ca. 1.39 ac), and Hamilton site was the largest (ca. 1.79 ac). The area surveyed at each site was from the paved roadway to the fence and to the boundary of each site that were marked by FDOT signs designated as "Test Site Project End".

Plant species are being documented and assessed by others involved with a separate study at these test sites. Nonetheless, Bahia grass (*Paspalum notatum*) was the dominant vegetation at all three sites. At all three sites, mowing beyond the backslope was excluded since the beginning of spring 2016.

The Columbia County Site was historically a sandhill natural community, characterized by Alpin fine sand soils (Howell 1984, Soil survey of Columbia County, Florida). One sandhill indicator species that was observed at the site was active pocket gopher mounds. Adjacent to the site was an abandoned agricultural field with abundant local native groundcover and was a pine plantation at least through 2014. This site lies within a half mile radius of several publicly protected to natural lands including Gar and Horse Ponds (Suwannee River Water Management District), Little and Big Shoals (Florida Fish and Wildlife Conservation Commission (FWC), SRWMD, Florida Forest Service (FFS), Florida Park Service (FPS)), as well as the state designated Outstanding Florida Water (OFW), namely the Suwannee River.

The Union County Site was historically a pine flatwoods natural community, characterized by Pelham-Pelham wet fine sands (Dearstyne, Leach and Sullivan 1991, Soil Survey of Union County, Florida). Adjacent to the site is a large plantation area of young pine. This site lies within a 0.5-mile radius of numerous relatively undisturbed marshes and forested wetlands, and is less than two miles in proximity from a significant tributary of the Santa Fe River (i.e. New River). In addition, this site falls within a nearly 7,500-acre piece of mostly undeveloped public property that is managed by Florida (i.e. Raiford State Prison).

The Hamilton County Site was historically a pine flatwoods natural community, characterized by Mascotte sands (Weatherspoon, Howell, and Baldwin 2004, Soil survey of Hamilton County, Florida). Immediately adjacent to the site is the largest open phosphate mine pit found in north Florida (i.e. White Springs PCS phosphate). The extent of mining associated from this facility is nearly 150 square miles and it has been actively producing mined earthen minerals since the 1960s. The site is also nearly five miles northeast of the Suwannee River. A significant drainage ditch ran parallel to the western boundary of this site.

Each study site was visited once a month between the period from 5 July 2017 to 19 October 2017. As many invertebrates as possible that were encountered during each sampling effort were identified to their lowest taxon. Photographs were taken of any species that could not be identified during the survey for later assessment. For invertebrate surveys, the entire area of each study site was systematically walked with a survey distance that ranged from 0.5 mile to 1.0 mile each visit. Each site was surveyed for at least one hour, but no more than 2 hours.

RESULTS

During this study, the abundance of a few of the taxa encountered at some sites (e.g., bees and grasshoppers) was so dense that it was difficult to identify every individual, therefore undoubtedly some were missed and counts were low for these species. Additionally, during this study many taxa were only identified by using photographic data. Some grasshopper species, for example, are morphologically similar and must be individually inspected in hand for positive identification. For this reason, some species names in this report are tentative, and could change with additional information. A complete list of species observed during this study is listed in Appendix I.

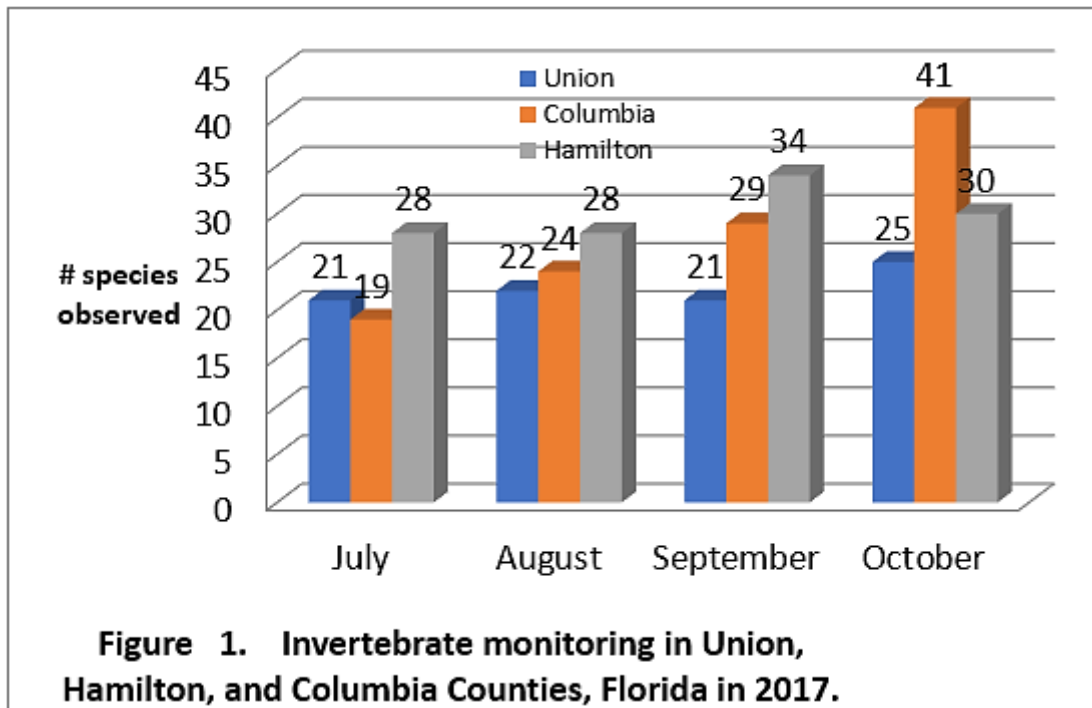
The total amount of invertebrate survey effort across all sites was close to 16 hours, with Hamilton and Columbia each receiving approximately 23 more minutes of survey time. Table 1 summarizes the total number of species observed at each of the three study sites.

Table 1. Invertebrate monitoring in Union, Hamilton, and Columbia Counties, Florida, in 2017

Site	Total # Species	Total # Species by Taxa		
		Lepidoptera	Odonata	Orthoptera
Hamilton	68	20	13	17
Union	52	19	8	14
Columbia	72	23	10	19
Total # Individuals		492	428	386

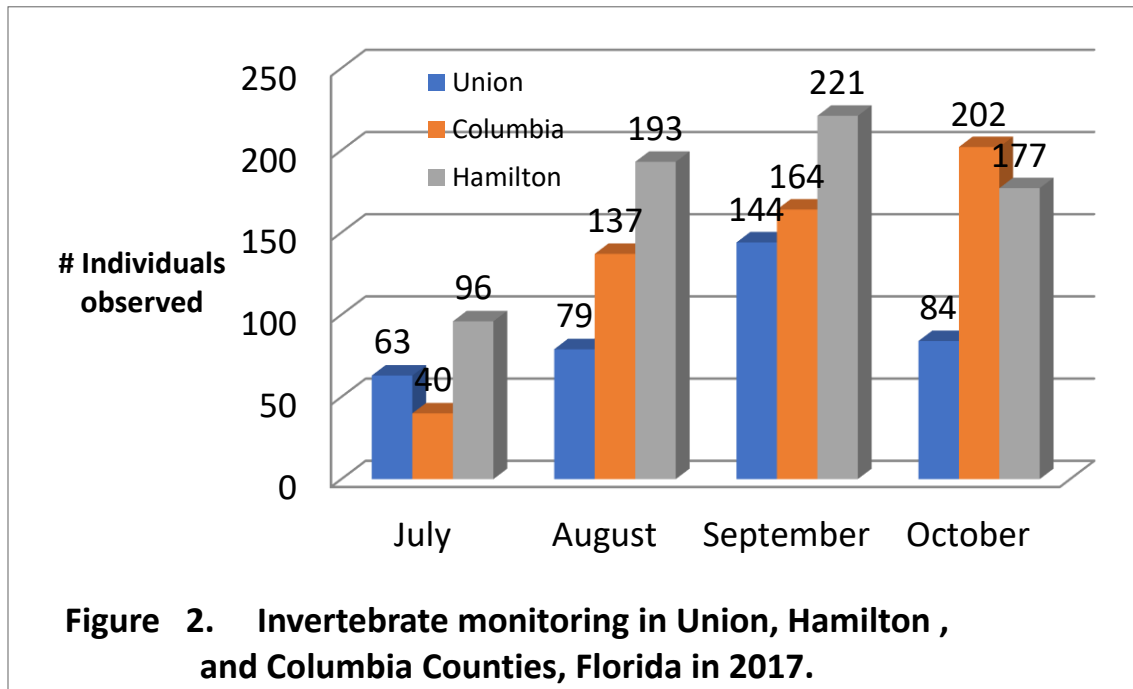
The Columbia Site had greatest total number of species observed during this five-month study. Additionally, Columbia also had the greatest total number of species within two of the three most diverse taxa observed during the study.

Figure 1 summarizes the overall number of species observed during the study. The greatest number of



species was observed in October. A total of 120 invertebrate species were identified during this study. In general, the number of observed invertebrate species gradually increased from July to October.

Figure 2 summarizes the total number of individual invertebrates observed during the study. The



greatest number of individuals that were observed occurred during the month of September (i.e. 529), and the lowest occurred in July (i.e. 199). The most abundant species observed on any one day during the study was 150 Love bugs (*Plecia nearctica*) in September. Roseate skimmers (*Orthemis ferruginea*) were the second most abundant invertebrate overall during the study with a total of 147 individuals observed. However, more butterflies (i.e. 492) were observed than any other taxa during the study. The two most abundantly observed butterflies were the Barred yellow (*Eurema daira*) and Gulf fritillary (*Agraulis vanilla*). The most abundant grasshopper during the study was American bird grasshopper (*Schistocerca americana*).

CONCLUSIONS

During this FDOT roadside monitoring study there was a total of 120 different invertebrate species identified from the period July 5 to October 19, 2017. There were no imperiled invertebrates observed during this study. The three study sites chosen were each unique in their own respects, but the invertebrate diversity was highest at the Columbia Site. Columbia also appeared to have an abundance of adjacent local wildflower diversity much more than the other two study sites, especially along the fence line. The smaller survey area of the Union Site may have played a role in decreased numbers of species and individuals observed. Additionally, at this site, the amount of survey area was also constrained by the large amount of dense vegetation (e.g., impenetrable wall of *Smilax*, *Rubus*...) along the entire fence line throughout the study. The drainage ditch adjacent to the Hamilton site probably played a significant role with some species, such as one of the most abundant invertebrates (i.e. Roseate skimmer).

Appendix I. Invertebrate monitoring species list for surveys in Union, Hamilton, and Columbia Counties, Florida in 2017.

Groups	Species
Butterflies (Lepidoptera)	
Swallowtails (Papilionidae)	
	Zebra <i>Eurytides marcellus</i>
	Palamedes <i>Papilio palamedes</i>
Sulphurs (Coliadinae)	
	Barred yellow <i>Eurema daira</i>
	Sleepy orange <i>Abaeis nicippe</i>
	Cloudless sulphur <i>Phoebis sennae</i>
	Little yellow sulphur <i>Pyrisitia lisa</i>
Hairstreaks (Theclinae)	
	Gray hairstreak <i>Strymon melinus</i>
	Red-banded hairstreak <i>Calycopis cecrops</i>
Blues (Polyamatinae)	
	Ceraunus blue <i>Hemiargus ceraunus</i>
Heliconians (Heliconiinae)	
	Gulf fritillary <i>Agraulis vanillae</i>
	Zebra heliconian <i>Heliconius charithonia</i>
	Varigated fritillary <i>Euptoietia claudia</i>
Brushfoots (Nymphalinae)	
	Phaon crescent <i>Phyciodes phaon</i>
	Buckeye <i>Junonia coenia</i>
	Pearl crescent <i>Phyciodes tharos</i>
Saytrs (Satyrinae)	
	Carolina saytr <i>Hermeuptychia sosybia</i>
Milkweed type (Danainae)	
	Viceroy <i>Limenitis archippus</i>
	Monarch <i>Danaus plexippus</i>
Dicot skippers (Eudaminae)	
	Long-tailed skipper <i>Urbanus proteus</i>
	Dorantes longtail <i>Urbanus dorantes</i>
Spread-wing skippers (Pyrginae)	
	Confused cloudywing <i>Thorybes confusis</i>
	Horaces duskywing <i>Erynnis horatius</i>
	Common checkered skipper <i>Pyrgus communis</i>
Grass skippers (Hesperiinae)	
	Whirlabout <i>Polites vibex</i>
	Fiery skipper <i>Hylephila phyleus</i>
	Baracoa skipper <i>Polites baracoa</i>
	Crossline skipper <i>Polites origenes</i>
	Southern broken dash <i>Wallengrenia otho</i>
	Sachem <i>Atalopedes campestris</i>
	Dunn skipper <i>Polites peckius</i>

Grass skippers (Hesperiinae) *continued*
Eufala skipper *Lerodea eufala*
Ocola skipper *Panoquina ocola*

Grasshopper, katydid, & cricket (Orthoptera)

Grasshoppers (Caelifera)

Short-horned grasshopper (Acrididae)

Slant-faced (Gomphocerinae)

Amblytropida type

Brown winter grasshopper *Amblytropidia mysteca*

Admirable grasshopper *Syrbula admirabilis*

Orphulella type

Short-winged green grasshopper *Dichromorpha viridis*

Toothpick (Mermiria type)

Eastern mermiria *Mermiria intertexta*

Lively mermiria *Mermiria picta*

Longgrasshoppereaded grasshopper *Achurum carinatum*

Band-winged (Oedipodinae)

Southern green-striped grasshopper *Chortophaga viridifasciata*

Carolina grasshopper *Dissosteira carolina*

Wrinkled grasshopper *Hippiscus ocelote*

Marbled grasshopper *Spharagemon marmorata*

Ridgeback sand grasshopper *Spharagemon cristatum*

Longhorn bandwing grasshopper *Psinidia fenestralis*

Southern yellow-wing grasshopper *Arphia granulata*

Bird (Cyrtacanthacridinae)

American bird grasshopper *Schistocerca americana*

Mischievous grasshopper *Schistocerca damnifica*

Spur-throated (Melanoplinae)

Two-spined grasshopper *Melanoplus bispinosus*

Keeler's grasshopper *Melanoplus keeleri*

Southern red-legged grasshopper *Melanoplus propinquus*

Roundwinged grasshopper *Melanoplus rotundipennis*

Migratory grasshopper *Melanoplus sanguinipes*

Small spur-throated

Linearwinged grasshopper *Aptenopedes sphenarioides*

Atlantic grasshopper *Paroxya atlantica*

Long horned orthoptera (Ensifera)

Katydids (Tettigoniidae)

SE bush katydid *Scudderia cuneata*

Handsome meadow katydid *Orchelimum puchellum*

Red-headed meadow katydid *Orchelimum erythrocephalum*

Lesser meadow katydid *Conocephalus* sp.

Crickets (Gryllidea)

Unknown tree cricket

Dragonflies & damselflies (Odonata)

Dragonflies (Anisoptera)

Darners (Aeshnidae)

Common green darner *Anax junius*

Skimmers (Libellulidae)

Great blue skimmer *Libellula vibrans*

Eastern amberwing *Perithemis tenera*

Little blue dragonlet *Erythrodiplax minuscula*

Blue dasher *Pachydiplax longipennis*

Eastern pondhawk *Erythemis simplicicollis*

Halloween pennant *Celithemis eponina*

Amanda's pennant *Celithemis amanda*

Black saddlebags *Tamea lacerate*

Carolina saddlebags *Tamea carolina*

Wandering glider *Pantala flavescens*

Roseate skimmer *Orthemis ferruginea*

Damselflies (Zygoptera)

Familiar bluet *Enallagma civile*

Rambur's fork-tail *Ischnura ramburii*

Fragile fork-tail *Ischnura posita*

Citrine fork-tail *Ischnura hastata*

Southern sprite *Nehalennia integriceps*

Flies (Diptera)

Deer flies (Tabanidae)

Yellow fly *Diachlorus ferrugatus*

Robberflies (Asilidae)

Bearded robberfly *Efferia albibarbis*

Hanging thief robberfly *Diogmites esiriensis*

Unknown robberfly

Unknown Sphyrinid bee-looking fly

Other flies

Firefly *Pyroactomena borealis*

Love bug *Plecia nearctica*

Bees & wasps (Hymenoptera)

Bumble bees

Common eastern bumblebee *Bombus impatiens*

American bumblebee *Bombus pensylvanicus*

Unknown bumble bee

Carpenter bees (Xylocopinae)

Eastern carpenter bee *Xylocopa virginica*

Southern carpenter bee *Xylocopa micans*

Other bees

Common long-horned bee *Melissodes communis*

Western honeybee *Apis mellifera*

Unknown bee

Brown-winged striped sweat bee *Agapostemon splendens*

Dilemma orchid bee *Euglossa dilemma*

Wasps

Great black wasp *Sphex pensylvanicus*
Blue-wing wasp *Scolia nobilitata*
Thread-waisted wasp *Ammophila procera*
Polistes paper wasp *Polistes* sp.
Red wasp *Polistes carolina*
Five-banded Thynnid wasp *Myzinum quinquecinctum*
Mole cricket hunter *Larra bicolor*
Potter wasp *Eumenes fraternus*
Unknown wasp
Bembicini wasp
Unknown sand wasp

Beetles (Coleoptera)

Flat-headed bald cypress borer *Acmaeodera pulchella*
Hairy darkling beetle *Epitragodes tomentosus*
Darkling beetle *Bothrotes canaliculatus canaliculatus*
Punctuated tiger beetle *Cicindelidia punctulata*
Ground beetle *Patrobis longicolis*
Tumbling flower beetles (Mordellidae)
Unknown tumbling flower beetle

True bugs (Hemiptera)

Florida bee assassin *Apiomerus floridensis*
Stinkbugs (Pentatomidae)
One-spotted stinkbug *Euschistus variolarius*
Unknown stinkbug
Shield-backed bugs (Scutelleridae)
Shield-backed bug *Orsilochides guttata*
Assassin bug *Doldina interjungens*
Large milkweed bug *Oncopeltus fasciatus*
Leaf-footed bugs
Eastern leaf-footed bug *Leptoglossus phyllopus*
Leaf-footed bug *Leptoglossus oppositus*

Spiders (Arachnida)

Banded argiope *Argiope trifasciata*
Black and yellow argiope *Argiope aurantia*
Green lynx *Peucetia viridans*