

**Report on Qualitative and Quantitative Monitoring
at Four Northwest Florida Water Management District
Mitigation Sites, Fall 2012**

by

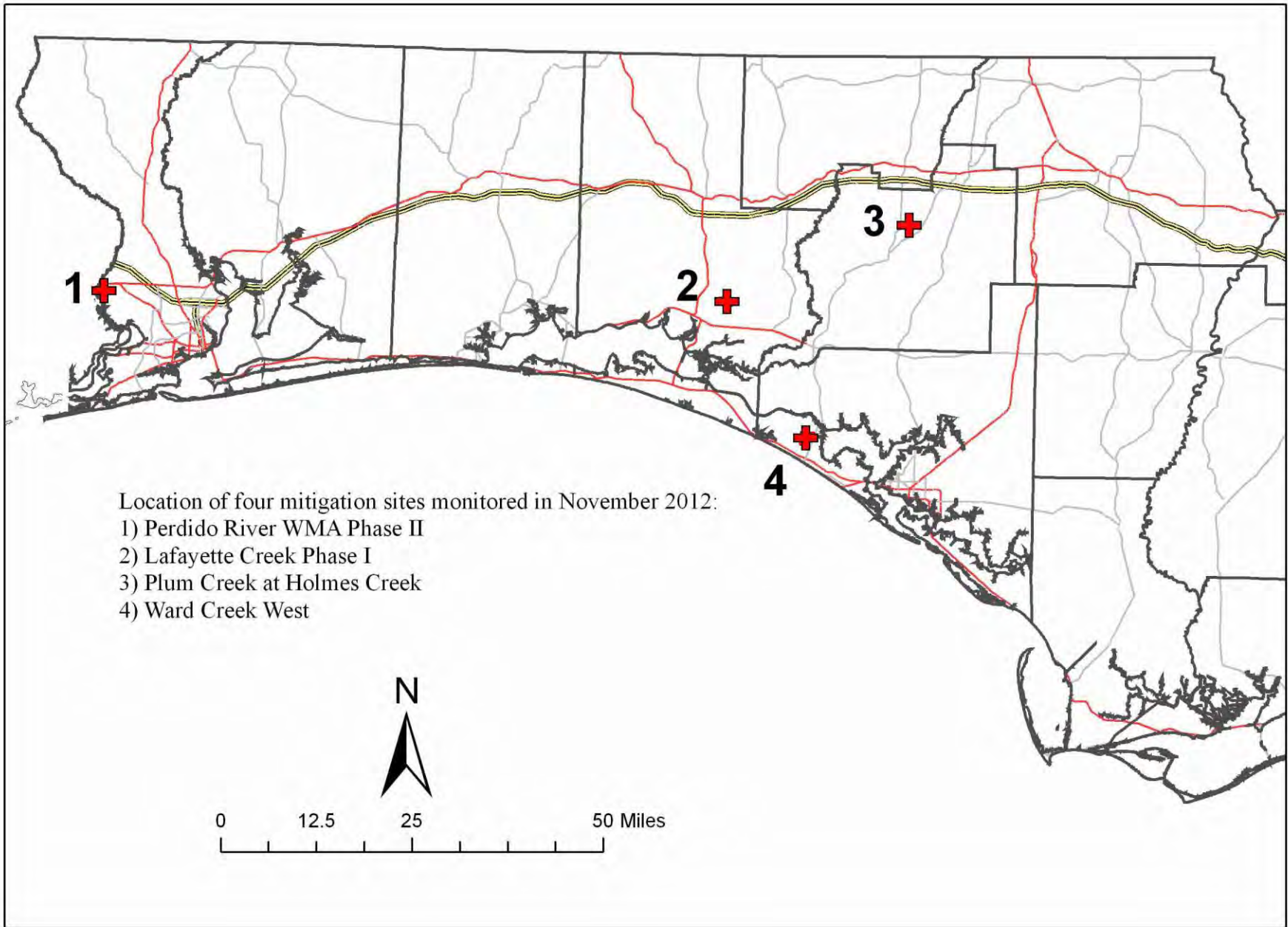
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December 2012**

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Funding for this project was provided by the Northwest Florida Water Management District under an agreement PO 00130105-000 with the Florida Natural Areas Inventory/Florida State University

This document contains four separate reports on the results of Fall 2012 qualitative and quantitative monitoring of plant species at four mitigation sites managed by the Northwest Florida Water Management District:

- 1) Perdido River Water Management Area – Phase II in Escambia County
- 2) Lafayette Creek – Phase I in Walton County
- 3) Plum Creek at Holmes Creek in Washington County
- 4) Ward Creek West in Bay County



Perdido River Water Management Area – Phase II Mitigation Site
Qualitative and Quantitative Monitoring
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Introduction

The Perdido River WMA Phase II mitigation project compensates for the loss of wetland function of bottomland hardwood forest from the 2007 replacement of the US 90 Perdido River Bridge in Escambia County, Florida. It consists of 67 acres in the Perdido River Water Management Area located south of US 90 (Nine Mile Road), 6.4 miles west of the junction of US 90 and I-10 (Figure 1). The Phase II Mitigation project aims to restore areas formerly in loblolly pine plantation (planted 2002) to mixed forested wetlands (MFW), hydric savanna (HS), hydric pine flatwoods (HPF) and mesic pine flatwoods (PF; Figure 1). Quantitative and qualitative monitoring documents the current plant species composition and vegetation structure of communities targeted for restoration and enhancement.

Methods

The 2012 quantitative monitoring consisted of staking the endpoints of six 150-ft permanent transect lines in communities to be restored: two in the hydric savanna, two in the mixed forested wetland, and two in the hydric pine flatwoods (Figure 2). Percent cover of each species was estimated in meter square quadrats set every 20 feet along each transect (including the 0 point), totaling eight quadrats per transect. Qualitative monitoring consisted of walking through the polygons and noting the species and vegetation structure for the three communities listed above, as well as for the mesic pine flatwoods community (PF).

Results

Hydric Savanna

Qualitative sampling. At time of sampling, the area with the target community of hydric savanna alternated between lower rows of saturated soil and some standing water and higher rows dominated by tall grasses. Shrubs were found primarily along the lines of former windrows on the highest areas. Overall, the area is dominated by tall grasses (purple bluestem with lesser amounts of broomsedge bluestem) with sphagnum moss, and viviparous spikerush in the lower areas and shrubs of sawtooth blackberry, black titi, and coastalplain St John's wort on the higher former windrows. Other common herbs included pinebarren goldenrod, Spanish needles, beaksedges, and meadowbeauties. The total number of species observed in this community was 38 (Table 1), three of which were not identifiable. There are undoubtedly other species present in this area that were not observed due to the advanced stage of the growing season at the time of sampling.

Quantitative sampling. Transect 1 (Table 2, Figure 2) had a total of 19 species and a total species cover of 94%. The highest percent cover was by sphagnum moss (29%), with five other species making up the bulk the remaining cover (purple bluestem, viviparous spikerush, fascicled beaksedge, and Spanish needles). Transect 2 (Table 3, Figure 3) was similar, having a total of 18 species, of which two could not be identified, and a total species cover of 92%. Again sphagnum moss made up the highest percentage cover (30%) with the bulk of the remaining cover contributed by purple bluestem, pinebarren goldenrod, an unknown graminoid, bromelike sedge, and sawtooth blackberry.

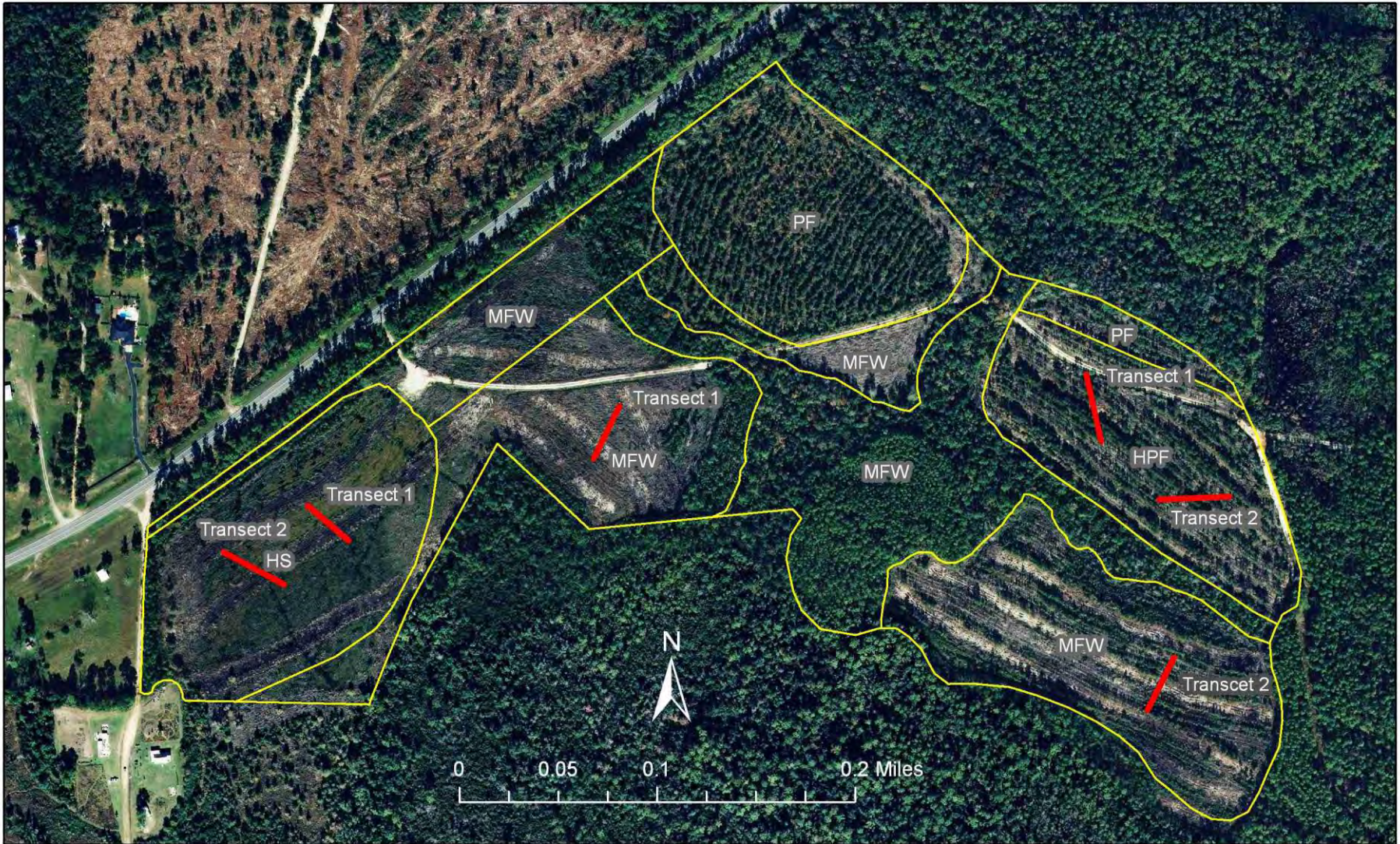


Figure 1. Location of permanent transects at Perdido Phase II Mitigation Site. HS=Hydric Savanna, HPF=Hydric Pine Flatwoods, MPF=Mixed Forested Wetlands, PF=Pine Flatwoods.

Table 1. Species observed in target communities at Perdido River WMA – Phase II Mitigation Site , November 26-29, 2012.

Scientific Name	Common Name	Hydric Pine Flatwood	Hydric Savanna	Pine Flatwoods	Mixed Forested Wetland
<i>Acer rubrum</i>	red maple		X	X	
<i>Agalinis cf. fascicularis*</i>	beach false foxglove				X
<i>Agalinis sp.</i>	false foxglove		X		
<i>Ageratina sp.</i>	snakeroot			X	
<i>Aletris sp.</i>	colic-root				X
<i>Andropogon glomeratus var. glaucopsis</i>	purple bluestem	X	X	X	X
<i>Andropogon virginicus</i>	broomsedge bluestem	X	X		X
<i>Aristida spiciformis</i>	bottlebrush threeawn				X
<i>Aristida stricta var. beyrichiana</i>	wiregrass	X		X	
<i>Arundinaria gigantea</i>	switchcane				X
<i>Bidens bipinnata</i>	Spanish needles		X		X
<i>Carex albolutescens</i>	greenwhite sedge		X		
<i>Carex bromoides</i>	bromelike sedge	X	X		
<i>Carex glaucescens</i>	clustered sedge		X	X	
<i>Castanea crenata</i>	Japanese chestnut (non-native)			X	
<i>Cliftonia monophylla</i>	black titi				X
<i>Cyrilla racemiflora</i>	titi				X
<i>Dichanthelium scabriusculum</i>	woolly witchgrass	X			X
<i>Dichanthelium sp.</i>	witchgrass				X
<i>Drosera capillaris</i>	pink sundew				X
<i>Eleocharis vivipara</i>	viviparous spikerush		X		
<i>Elephantopus nudatus</i>	smooth elephantsfoot	X		X	
<i>Eragrostis elliottii</i>	Elliott's lovegrass	X			
<i>Eupatorium capillifolium</i>	dogfennel	X		X	X
<i>Eupatorium sp.</i>	thoroughwort				X
<i>Euthamia caroliniana</i>	slender flattop goldenrod	X	X	X	X
<i>Fuirena breviseta</i>	saltmarsh umbrellasedge		X		
<i>Hydrocotyle umbellata</i>	manyflower marshpennywort		X		
<i>Hypericum brachyphyllum</i>	coastalplain St. John's wort		X		X
<i>Hypericum cistifolium</i>	roundpod St. John's wort			X	X
<i>Hypericum crux-andreae</i>	St. Peter's wort	X			X
<i>Hypericum hypericoides</i>	St. Andrew's cross			X	
<i>Ilex coriacea</i>	large gallberry			X	X
<i>Ilex glabra</i>	gallberry			X	X
<i>Ilex opaca</i>	American holly	X			
<i>Ilex vomitoria</i>	yaupon			X	X
<i>Juncus dichotomus</i>	forked rush	X	X		
<i>Juncus marginatus</i>	grassleaf rush				X
<i>Kalmia hirsuta</i>	hairy wicky				X
<i>Lachnanthes caroliniana</i>	Carolina redroot		X		X
<i>Lachnocaulon anceps</i>	whitehead bogbutton	X			
<i>Lachnocaulon sp.</i>	bogbutton				X
<i>Ludwigia linearis</i>	narrowleaf primrosewillow		X		X

Scientific Name	Common Name	Hydric Pine Flatwood	Hydric Savanna	Pine Flatwoods	Mixed Forested Wetland
<i>Ludwigia suffruticosa</i>	shrubby primrosewillow		X		
<i>Lycopodiella alopecuroides</i>	foxtail club-moss	X		X	X
<i>Lycopodiella appressa</i>	southern club-moss				X
<i>Lygodium japonicum</i>	Japanese climbing fern			X	
<i>Lyonia lucida</i>	fetterbush				X
<i>Magnolia grandiflora</i>	southern magnolia	X			
<i>Magnolia virginiana</i>	sweetbay		X	X	X
<i>Myrica cerifera</i>	wax myrtle	X	X	X	X
<i>Myrica inodora</i>	odorless bayberry	X			
<i>Oldenlandia uniflora</i>	clustered mille grains	X			X
<i>Osmunda cinnamomea</i>	cinnamon fern	X	X		
<i>Osmunda regalis</i> var. <i>spectabilis</i>	royal fern			X	
<i>Panicum anceps</i>	beaked panicum	X	X	X	
<i>Panicum virgatum</i>	switchgrass	X			
<i>Persea palustris</i>	swamp bay	X	X	X	X
<i>Photinia pyrifolia</i>	red chokeberry		X		X
<i>Pinus elliottii</i>	slash pine		X		X
<i>Pinus taeda</i>	loblolly pine	X		X	X
<i>Pluchea longifolia</i>	longleaf camphorweed	X			
<i>Polygala lutea</i>	orange milkwort				X
<i>Polytrichum commune</i>	haircap moss	X		X	X
<i>Pteridium aquilinum</i>	bracken fern				X
<i>Quercus nigra</i>	water oak	X		X	X
<i>Rhexia</i> sp.	meadowbeauty	X	X		X
<i>Rhexia virginica</i>	handsome harry		X		
<i>Rhynchospora baldwinii</i>	Baldwin's beaksedge				X
<i>Rhynchospora cephalantha</i>	bunched beaksedge		X		X
<i>Rhynchospora chapmanii</i>	Chapman's beaksedge				X
<i>Rhynchospora ciliaris</i>	fringed beaksedge				X
<i>Rhynchospora fascicularis</i>	fascicled beaksedge		X		X
<i>Rhynchospora microcephala</i>	bunched beaksedge		X		X
<i>Rhynchospora plumosa</i>	plumed beaksedge				X
<i>Rhynchospora</i> sp.	beaksedge				X
<i>Rubus argutus</i>	sawtooth blackberry	X	X	X	X
<i>Sabatia brevifolia</i>	shortleaf rosegentian				X
<i>Saccharum</i> sp.	cupscale	X			
<i>Scirpus cyperinus</i>	woolgrass		X		
<i>Scleranthus annuus</i>	German knotgrass	X			
<i>Scleria triglomerata</i>	whip nutrush	X			
<i>Serenoa repens</i>	saw palmetto				X
<i>Smilax bona-nox</i>	saw greenbrier			X	
<i>Smilax glauca</i>	cat greenbrier	X		X	X
<i>Smilax laurifolia</i>	laurel greenbrier				X
<i>Solidago fistulosa</i>	pinebarren goldenrod	X	X	X	X
<i>Sphagnum</i> sp.	sphagnum moss	X	X	X	X

Scientific Name	Common Name	Hydric Pine Flatwood	Hydric Savanna	Pine Flatwoods	Mixed Forested Wetland
<i>Symphyotrichum dumosum</i>	rice button aster			X	
<i>Symphyotrichum walteri</i>	Walter's aster	X			X
<i>Syngonanthus flavidulus</i>	yellow hatpins				X
<i>Taxodium ascendens</i>	pond cypress				X
<i>Toxicodendron radicans</i>	eastern poison ivy	X			
unknown composite	unknown composite	X			X
unknown graminoid	unknown graminoid	X	X		X
unknown herb	unknown herb	X			
unknown large matted moss	unknown large matted moss		X		
unknown monocot	unknown monocot		X		
unknown moss	unknown moss	X			
<i>Vaccinium elliotii</i>	Elliott's blueberry	X		X	
<i>Viola lanceolata</i>	bog white violet				X
<i>Viola</i> sp.	violet	X			
<i>Vitis rotundifolia</i>	muscadine	X		X	X
<i>Woodwardia areolata</i>	netted chain fern	X		X	X
<i>Woodwardia virginica</i>	Virginia chain fern	X	X	X	
<i>Xyris ambigua</i>	coastalplain yellow-eyed grass				X
<i>Xyris fimbriata</i>	fringed yellow-eyed grass		X		
<i>Xyris flabelliformis</i>	savannah yellow-eyed grass				X
<i>Xyris</i> sp.	yellow-eyed grass			X	X
Grand Total=109		45	38	34	68

*cf indicates identification uncertain.

Figure 2. Percent species cover in Hydric Savanna Transect 1.

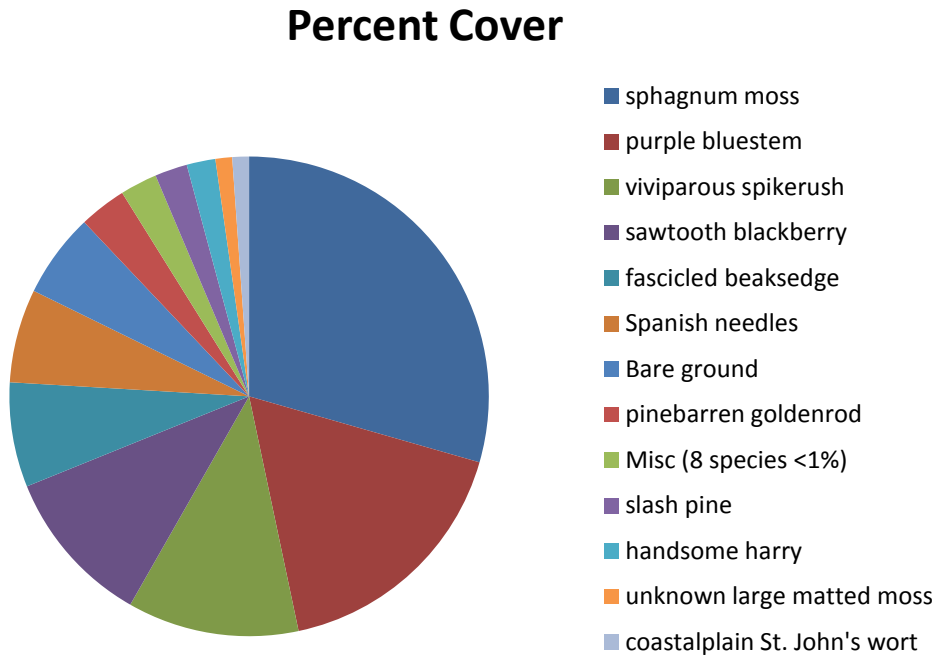


Table 2. Percent species cover in Hydric Savanna Transect 1 (sampled on 11/26/12).

Scientific name	Common name	Average percent cover per quadrat
<i>Andropogon glomeratus</i> var. <i>glaucopsis</i>	purple bluestem	17.25
<i>Bidens bipinnata</i>	Spanish needles	6.31
<i>Carex albolutescens</i>	greenwhite sedge	0.06
<i>Eleocharis vivipara</i>	viviparous spikerush	11.56
<i>Hydrocotyle umbellata</i>	manyflower marshpennywort	0.06
<i>Hypericum brachyphyllum</i>	coastalplain St. John's wort	1.13
<i>Lachnanthes caroliniana</i>	Carolina redroot	0.81
<i>Ludwigia suffruticosa</i>	shrubby primrosewillow	0.44
<i>Panicum anceps</i>	beaked panicum	0.06
<i>Pinus elliotii</i>	slash pine	2.19
<i>Rhexia virginica</i>	handsome harry	1.94
<i>Rhynchospora fascicularis</i>	fascicled beaksedge	7.06
<i>Rhynchospora microcephala</i>	bunched beaksedge	0.94
<i>Rubus argutus</i>	sawtooth blackberry	10.63
<i>Solidago fistulosa</i>	pinebarren goldenrod	3.19
<i>Sphagnum</i> sp.	sphagnum moss	29.44
unknown large matted moss	unknown large matted moss	1.13
unknown monocot	unknown monocot	0.06
<i>Woodwardia virginica</i>	Virginia chain fern	0.06
	Bare ground	5.69

Figure 3. Percent species cover in Hydric Savanna Transect 2.

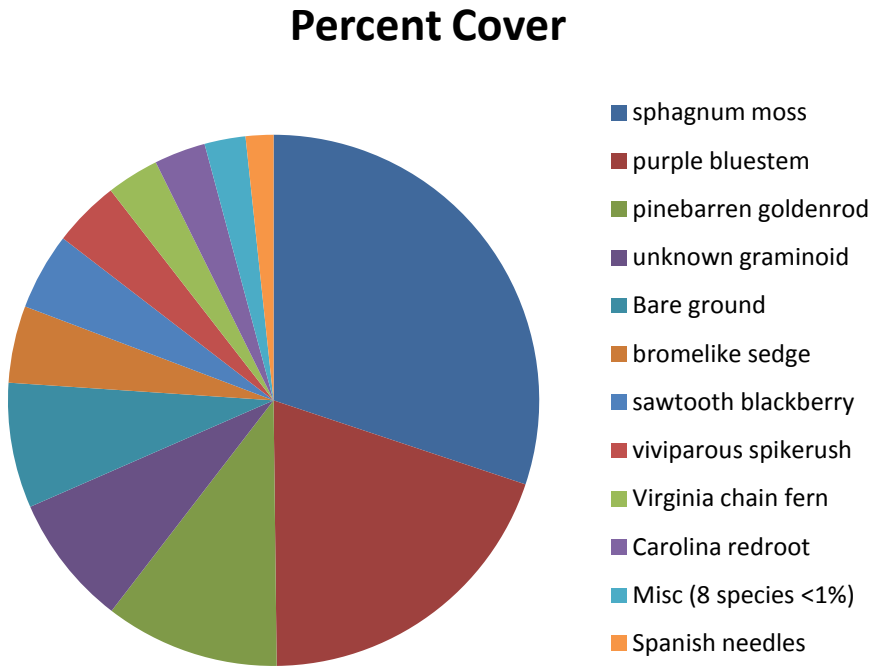


Table 3. Percent species cover in Hydric Savanna Transect 2 (sampled on 11/26/12).

Scientific name	Common name	Average percent cover per quadrat
<i>Agalinis</i> sp.	false foxglove	0.19
<i>Andropogon glomeratus</i> var. <i>glaucoptis</i>	purple bluestem	19.69
<i>Bidens bipinnata</i>	Spanish needles	1.69
<i>Carex albolutescens</i>	greenwhite sedge	0.06
<i>Carex bromoides</i>	bromelike sedge	4.69
<i>Eleocharis vivipara</i>	viviparous spikerush	4.06
<i>Hydrocotyle umbellata</i>	manyflower marshpennywort	0.06
<i>Hypericum brachyphyllum</i>	coastalplain St. John's wort	0.50
<i>Lachnanthes caroliana</i>	Carolina redroot	3.13
<i>Rhexia virginica</i>	handsome herry	0.13
<i>Rhynchospora fascicularis</i>	fascicled beaksedge	0.94
<i>Rubus argutus</i>	sawtooth blackberry	4.69
<i>Solidago fistulosa</i>	pinebarren goldenrod	10.63
<i>Sphagnum</i> sp.	sphagnum moss	30.13
unknown graminoid	unknown graminoid	8.00
unknown large matted moss	unknown large matted moss	0.19
<i>Woodwardia virginica</i>	Virginia chain fern	3.19
<i>Xyris fimbriata</i>	fringed yellow-eyed grass	0.44
	Bare ground	7.63

Mixed Forested Wetland

Qualitative sampling. At time of sampling, the areas of former plantation with the target community of mixed forested wetland (Figure 1) were dry with small areas of saturated soil in the dips. The vegetative cover consisted primarily of tall grassland dominated by broomsedge bluestem and purple bluestem, with shrubs and small trees (sawtooth blackberry, fetterbush, swamp bay, sweetbay) on the higher areas of former windrows, and lower areas dominated by sphagnum moss, haircap moss, and beaksedges. Young slash pines were widely scattered throughout. A small area in the eastern portion of the polygon that contained Transect 2 had several species not seen elsewhere in the mixed forested wetland polygons, including hairy wicky, Chapman’s beaksedge, bottlebrush threeawn, and saw palmetto. Broomsedge bluestem was less dense here than in the rest of the polygon. The total number of species observed in this community was 68 (Table 1).

Quantitative sampling. Transect 1 (Table 4, Figure 4) had a total of 28 species and a total species cover of 61%. The highest percent cover was by purple bluestem with 25% and the bulk of the remaining cover was contributed by sawtooth blackberry, broomsedge bluestem and haircap moss. Transect 2 (Table 5, Figure 5) had a total of 24 species and total species cover of 64%. The highest percent cover was by purple bluestem at 32% with the bulk of the remaining cover contributed by broomsedge bluestem and sphagnum moss.

Figure 4. Percent species cover in Mixed Forested Wetland Transect 1.

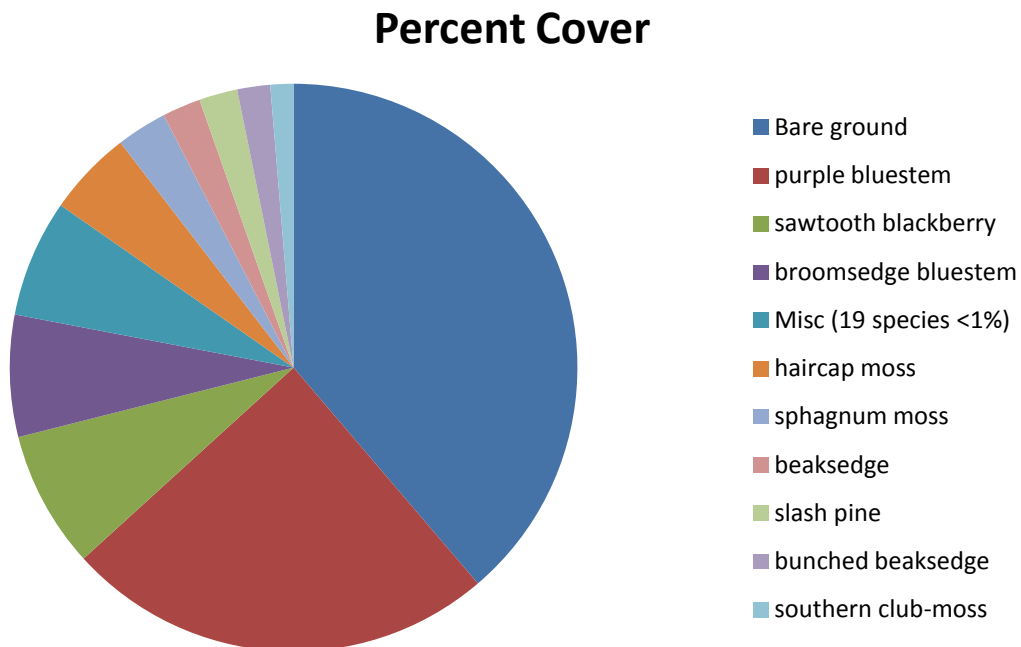


Table 4. Percent species cover in Mixed Forested Wetland Transect 1 (sampled on 11/28/12).

Scientific name	Common name	Average percent cover per quadrat
<i>Aletris</i> sp.	Aletris sp.	0.06
<i>Andropogon glomeratus</i> var. <i>glaucoptis</i>	purple bluestem	24.50
<i>Andropogon virginicus</i>	broomsedge bluestem	6.94
<i>Cliftonia monophylla</i>	black titi	0.25
<i>Cyrilla racemiflora</i>	titi	0.19
<i>Dichantheium</i> sp.	witchgrass	0.94
<i>Drosera capillaris</i>	pink sundew	0.19
<i>Hypericum cistifolium</i>	roundpod St. John's wort	0.44
<i>Lachnocaulon</i> sp.	bogbutton	0.19
<i>Lycopodiella appressa</i>	southern club-moss	1.31
<i>Lyonia lucida</i>	fetterbush	0.44
<i>Oldenlandia uniflora</i>	clustered mille grains	0.44
<i>Photinia pyrifolia</i>	red chokeberry	0.19
<i>Pinus elliotii</i>	slash pine	2.19
<i>Polytrichum commune</i>	haircap moss	4.88
<i>Rhexia</i> sp.	meadowbeauty	0.94
<i>Rhynchospora baldwinii</i>	Baldwin's beaksedge	0.44
<i>Rhynchospora fascicularis</i>	fascicled beaksedge	0.44
<i>Rhynchospora microcephala</i>	bunched beaksedge	1.88
<i>Rhynchospora plumosa</i>	plumed beaksedge	0.19
<i>Rhynchospora</i> sp.	beaksedge	2.19
<i>Rubus argutus</i>	sawtooth blackberry	7.81
<i>Smilax glauca</i>	cat greenbrier	0.25
<i>Solidago fistulosa</i>	pinebarren goldenrod	0.44
<i>Sphagnum</i> sp.	sphagnum moss	2.88
<i>Vitis rotundifolia</i>	muscadine	0.19
<i>Xyris flabelliformis</i>	savannah yellow-eyed grass	0.06
<i>Xyris</i> sp.-wiry leaves	Xyris sp.	0.44
	Bare ground	38.75

Figure 5. Percent species cover in Mixed Forested Wetland Transect 2.

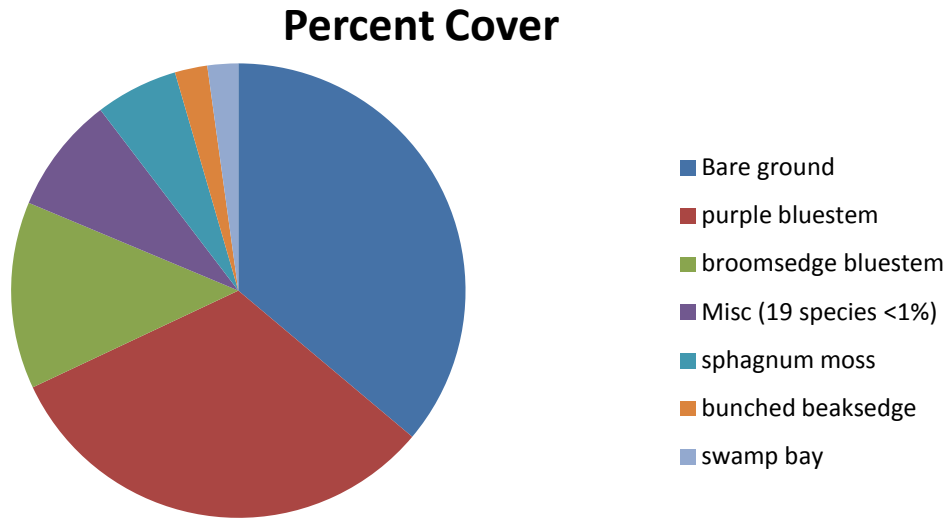


Table 5. Percent species cover in Mixed Forested Wetland Transect 2 (sampled on 11/28/12).

Scientific name	Common name	Average percent cover per quadrat
<i>Andropogon glomeratus</i> var. <i>glaucoptis</i>	purple bluestem	31.88
<i>Andropogon virginicus</i>	broomsedge bluestem	13.31
<i>Cliftonia monophylla</i>	black titi	0.94
<i>Dichantheium</i> sp.	witchgrass	0.44
<i>Hypericum brachyphyllum</i>	coastalplain St. John's wort	0.94
<i>Lachnanthes caroliana</i>	Carolina redroot	0.94
<i>Lycopodiella alopecuroides</i>	foxtail club-moss	0.19
<i>Oldenlandia uniflora</i>	clustered mille grains	0.25
<i>Persea palustris</i>	swamp bay	2.19
<i>Pinus taeda</i>	loblolly pine	0.44
<i>Polytrichum commune</i>	haircap moss	0.94
<i>Rhynchospora baldwinii</i>	Baldwin's beaksedge	0.19
<i>Rhynchospora cephalantha</i>	bunched beaksedge	2.31
<i>Rhynchospora chapmanii</i>	Chapman's beaksedge	0.06
<i>Rhynchospora fascicularis</i>	fascicled beaksedge	0.44
<i>Rubus argutus</i>	sawtooth blackberry	0.94
<i>Smilax glauca</i>	cat greenbrier	0.44
<i>Solidago fistulosa</i>	pinebarren goldenrod	0.06
<i>Sphagnum</i> sp.	sphagnum moss	5.88
<i>Symphotrichum walteri</i>	Walter's aster	0.19
unknown composite	unknown composite	0.06
unknown graminoid	unknown graminoid	0.19
<i>Viola lanceolata</i>	bog white violet	0.50
<i>Xyris</i> sp.	yellow-eyed grass	0.19
	Bare ground	36.13

Hydric Pine Flatwoods

Qualitative monitoring. At the time of sampling the area with the target community of hydric pine flatwoods was largely dry with only isolated areas of saturated soil in the dips. Vegetative cover consisted of a thinned bedded loblolly pine plantation of trees about 30 ft tall forming 40-50% cover. The understory was open, consisting of bare ground with alternating patches of wiregrass and broomsedge bluestem and scattered patches of shrubs including sawtooth blackberry, wax myrtle and swamp bay. Loblolly pine seedlings were scattered throughout. Total number of species observed was 45 (Table 1).

Quantitative monitoring. Transect 1 had a total of 22 species of which two were not identified and total species cover of 20 percent (Figure 6, Table 6). Most cover was contributed by wiregrass at 5.4% followed by sawtooth blackberry, bromelike sedge and loblolly pine seedlings. Transect 2 (Figure 7, Table 7) had a total of 25 species, of which three were not identified, and a total species cover of 38 percent. Most cover was contributed by broomsedge bluestem at 13 percent followed by bromelike sedge and sphagnum moss. A small amount of wiregrass was also present in this transect which was slightly wetter than Transect 1.

Figure 6. Percent species cover in Hydric Pine Flatwoods Transect 1.

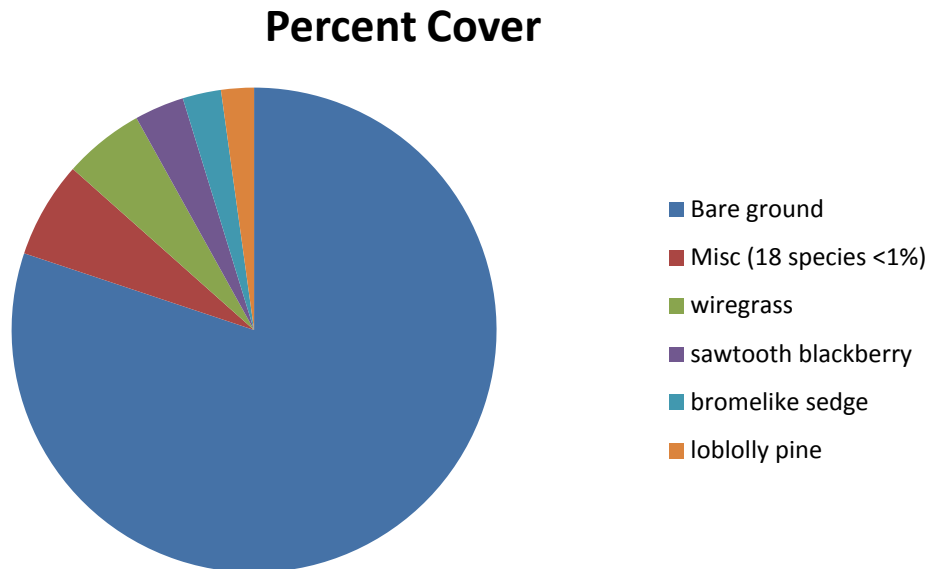


Table 6. Percent species cover in Hydric Pine Flatwoods Transect 1 (sampled on 11/29/12).

Scientific name	Common name	Average percent cover per quadrat
<i>Andropogon glomeratus</i> var. <i>glaucopsis</i>	purple bluestem	0.94
<i>Aristida stricta</i> var. <i>beyrichiana</i>	wiregrass	5.38
<i>Carex bromoides</i>	bromelike sedge	2.56
<i>Elephantopus nudatus</i>	smooth elephantsfoot	0.50
<i>Euthamia caroliniana</i>	slender flattop goldenrod	0.06
<i>Oldenlandia uniflora</i>	clustered mille grains	0.06
<i>Osmunda cinnamomea</i>	cinnamon fern	0.19
<i>Pinus taeda</i> -seedling	loblolly pine	0.75
<i>Pinus taeda</i> -trunk	loblolly pine	2.19
<i>Pluchea longifolia</i>	longleaf camphorweed	0.19
<i>Rhexia</i> sp.	meadowbeauty	0.19
<i>Rubus argutus</i>	sawtooth blackberry	3.31
<i>Saccharum</i> sp.	cupscale	0.94
<i>Smilax glauca</i>	cat greenbrier	0.44
<i>Solidago fistulosa</i>	pinebarren goldenrod	0.63
<i>Sphagnum</i> sp.	sphagnum moss	0.19
<i>Toxicodendron radicans</i>	eastern poison ivy	0.06
unknown herb	unknown herb	0.06
unknown moss	unknown moss	0.06
<i>Viola</i> sp.	violet	0.06
<i>Vitis rotundifolia</i>	muscadine	0.69
<i>Woodwardia virginica</i>	Virginia chain fern	0.44
	Bare ground	80.13

Figure 7. Percent species cover in Hydric Pine Flatwoods Transect 2.

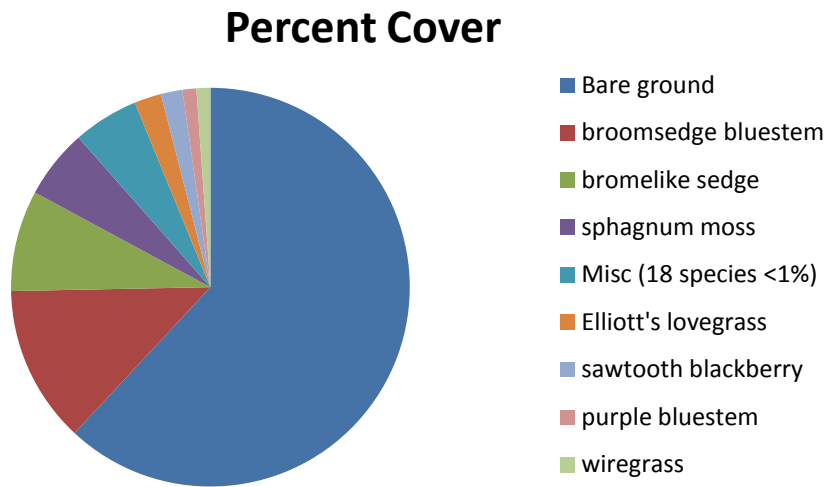


Table 7. Percent species cover in Hydric Pine Flatwoods Transect 2 (sampled on 11/29/12).

Scientific name	Common name	Average percent cover per quadrat
<i>Andropogon glomeratus</i> var. <i>glaucopsis</i>	purple bluestem	1.13
<i>Andropogon virginicus</i>	broomsedge bluestem	12.75
<i>Aristida stricta</i> var. <i>beyrichiana</i>	wiregrass	1.13
<i>Carex bromoides</i>	bromelike sedge	8.19
<i>Elephantopus nudatus</i>	smooth elephantsfoot	0.19
<i>Eragrostis elliotii</i>	Elliott's lovegrass	2.19
<i>Juncus dichotomus</i>	forked rush	0.06
<i>Lachnocaulon anceps</i>	whitehead bogbutton	0.63
<i>Myrica inodora</i>	odorless bayberry	0.44
<i>Oldenlandia uniflora</i>	clustered mille grains	0.13
<i>Pinus taeda</i> -seedling	loblolly pine	0.94
<i>Polytrichum commune</i>	haircap moss	0.44
<i>Quercus nigra</i> -seedling	water oak	0.06
<i>Rubus argutus</i>	sawtooth blackberry	1.75
<i>Scleranthus annuus</i>	German knotgrass	0.06
<i>Smilax glauca</i>	cat greenbrier	0.06
<i>Sphagnum</i> sp.	sphagnum moss	5.63
<i>Symphotrichum walteri</i>	Walter's aster	0.44
unknown graminoid	unknown graminoid	0.06
unknown herb	unknown herb	0.19
unknown moss	unknown moss	0.06
<i>Vaccinium elliotii</i>	Elliott's blueberry	0.44
<i>Vitis rotundifolia</i>	muscadine	0.06
<i>Woodwardia areolata</i>	netted chain fern	0.63
<i>Woodwardia virginica</i>	Virginia chain fern	0.44
	Bare ground	61.94

Pine Flatwoods

Qualitative monitoring. The area with a target community of pine flatwoods was currently dry and consisted of an open pine woods with a canopy of 30-45 ft, even-aged loblolly pines with broad canopies making up about 30-40% cover. Subcanopy and tall shrub hardwood species made up about 20% cover and consisted principally of water oak with smaller amounts of red maple and swamp bay. Short shrubs made up about 20% cover, primarily wax myrtle, gallberry and large gallberry. Wiregrass and broomsedge bluestem comprised most of the herb layer that covered less than 5% of the area. Needlefall was partially covering wiregrass in some areas and more heavily shaded portions of the ground layer were covered by a dense carpet of muscadine grape. A total of 34 species (Table 1) were seen in the pine flatwoods target area. A few patches of the invasive exotic, Japanese climbing fern were noted along the southern road edge but no more were encountered in the rest of the area.

A total of 107 native species and 2 exotic species were observed during the November 26-29, 2012 monitoring period over all the target communities at Perdido Phase II. Thirty-one of these had not been previously recorded in the 2008-2010 monitoring periods.

**Lafayette Creek - Phase I Mitigation Site
Qualitative and Quantitative Monitoring
December 2012**

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Introduction

The Lafayette Creek Phase I mitigation site compensates for the loss of wetland function from the impacts associated with US 331 Freeport re-alignment. It consists of 509 acres north of Lafayette Creek, accessible from the end of Hollington Road, which heads north from SR 20, 4.5 miles east of its junction with US 331. The Phase I Mitigation project aims to restore areas formerly in sand pine plantation to sandhill (SA), and areas of wetland shrubs to hydric savanna (HS). Quantitative and qualitative monitoring documents the current plant species composition and vegetation structure of these two communities targeted for restoration. Qualitative monitoring alone is used to document areas of former slash pine plantation being converted to high pine (HP), as well as two communities still in natural condition, bay swamp and stream swamp.

Methods

The 2012 quantitative monitoring consisted of staking the endpoints of four 300-ft permanent transect lines in polygons of communities to be restored: two in sandhill and two in hydric savanna (Figure 1). Percent cover of each species was estimated in meter square quadrats set every 20 feet along each transect (including the 0 point), totaling 15 quadrats per transect. Qualitative monitoring consisted of walking through the polygons and noting the species and vegetation structure for the two communities listed above, as well as for high pine, bay swamp and stream swamp.

Results

Sandhill

Qualitative sampling. At time of sampling, the area with the target community of sandhill was dry. The rolling sandy slopes were covered by an open grassland of wiregrass and broomsedge bluestem with much bare ground and a diverse mixture of forbs, including species characteristic of sandhill such as the Lynn Haven goldenaster and Piedmont gayfeather, as well the more generalist weedy species, such as orangegrass and yankeeweed. Patches of shrubs covered up to 30% of the area, composed predominantly of woody goldenrod, plus lesser amounts of turkey oak, saw palmetto, yaupon, and sand live oak. Mature longleaf pines were widely scattered and seedlings were frequent. The total number of species observed in this community was 82 (Table 1), one of which was not identifiable.

Quantitative sampling. Transect 1 (Table 2, Figure 2) had a total of 27 species and a total species cover of 37%. The highest percent cover was by saw palmetto (8%), with five other species making up the bulk the remaining cover (wiregrass, yaupon, tapered witchgrass, and Lynn Haven goldenaster). Transect 2 (Table 3, Figure 3) had a total of 22 species and a total species cover of 35%. Lynn Haven goldenaster made up the highest percentage cover (16%) with the bulk of the remaining cover contributed by wiregrass and tapered witchgrass.

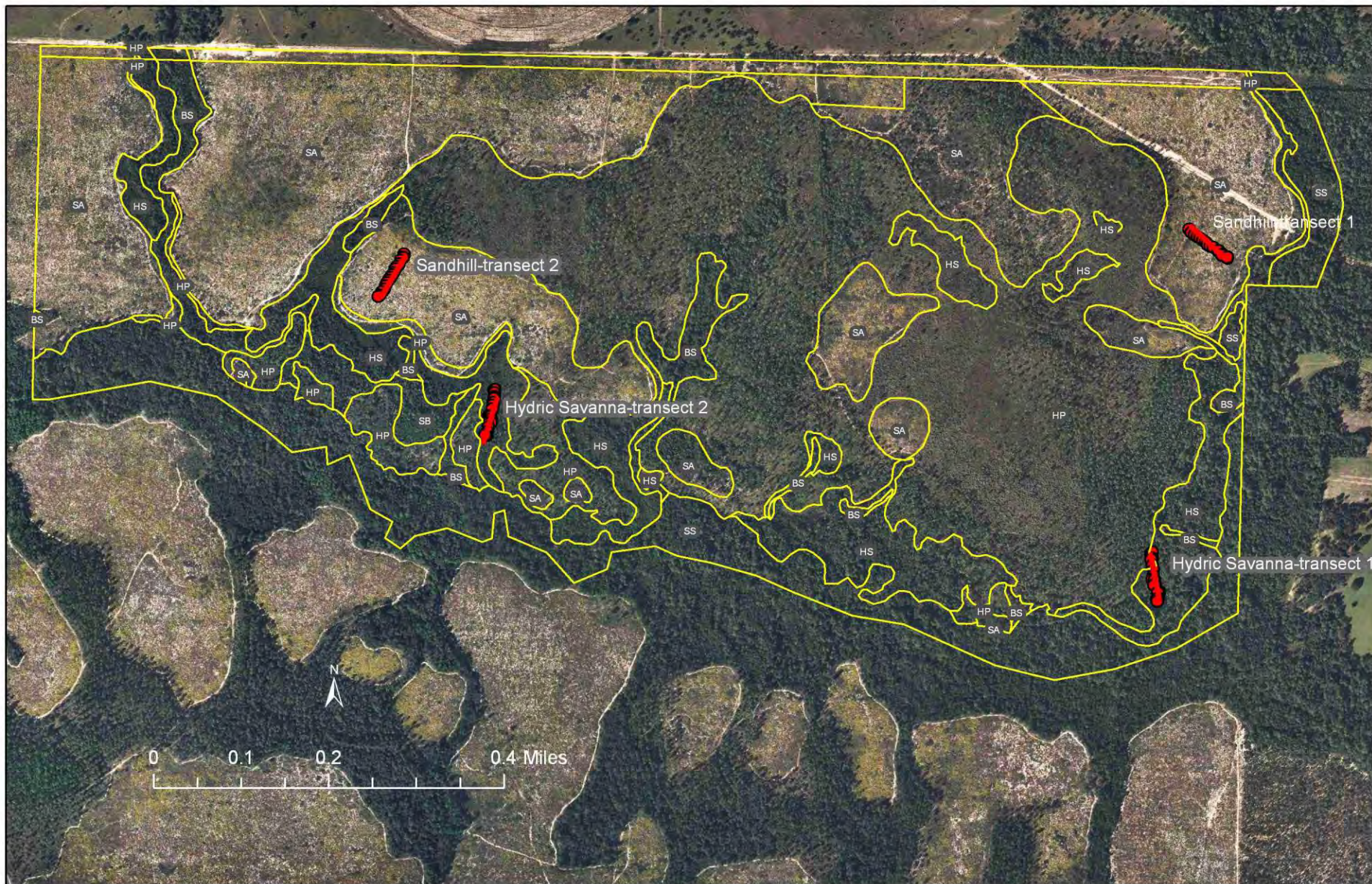


Figure 1. Location of permanent transects at Lafayette Creek – Phase I Mitigation Site. SA=Sandhill, HS=Hydric Savanna, HP=High Pine, BS=Bay Swamp, SS=Stream Swamp, SB=Shrub Bog.

Table 1. Species observed in target communities at Lafayette Creek – Phase I Mitigation Site, November 5-8, 2012.

Scientific Name	Common Name	Bay Swamp	High Pine	Hydric Savanna	Sandhill	Stream Swamp
<i>Acer rubrum</i>	red maple	X				X
<i>Agalinis fasciculata</i>	beach false foxglove			X		
<i>Alnus serrulata</i>	hazel alder	X				
<i>Amsonia ciliata</i>	fringed bluestar		X		X	
<i>Andropogon floridanus</i>	Florida bluestem			X		
<i>Andropogon glomeratus</i>	bushy bluestem			X		
<i>Andropogon glomeratus</i> var. <i>glaucopsis</i>	purple bluestem		X	X		
<i>Andropogon gyrans</i>	Elliott's bluestem		X			
<i>Andropogon gyrans</i> var. <i>stenophyllus</i>	Elliott's bluestem			X		
<i>Andropogon</i> sp.	bluestem			X		
<i>Andropogon ternarius</i>	splitbeard bluestem			X	X	
<i>Andropogon virginicus</i>	broomsedge bluestem			X	X	
<i>Andropogon virginicus</i> var. <i>glaucus</i>	chalky bluestem				X	
<i>Anthaenaria villosa</i>	green silkscale			X		
<i>Aristida purpurascens</i>	arrowfeather threeawn				X	
<i>Aristida stricta</i> var. <i>beyrichiana</i>	wiregrass		X	X	X	
<i>Arnoglossum sulcatum</i>	Georgia Indian-plantain	X		X		
<i>Arundinaria gigantea</i>	switchcane			X		
<i>Balduina angustifolia</i>	coastalplain honeycomb-head				X	
<i>Baptisia lanceolata</i>	gopherweed				X	
<i>Berlandiera pumila</i>	soft greeneyes				X	
<i>Bidens laevis</i>	smooth beggarticks	X				
<i>Bigelovia nudata</i>	pineland rayless goldenrod		X			
<i>Bulbostylis ciliatifolia</i>	capillary hairsedge				X	
<i>Carex glaucescens</i>	clustered sedge	X				
<i>Carex tenax</i>	sandhill sedge				X	
<i>Carphephorus odoratissimus</i>	vanillaleaf		X	X	X	
<i>Carphephorus pseudoliatris</i>	bristleleaf chaffhead			X		
<i>Chrysoma pauciflosculosa</i>	woody goldenrod				X	
<i>Chrysopsis lanuginosa</i>	Lynn Haven goldenaster				X	
<i>Chrysopsis mariana</i>	Maryland goldenaster		X			
<i>Cladonia leporina</i>	a lichen				X	
<i>Clethra alnifolia</i>	sweet pepperbush	X	X	X		X
<i>Cliftonia monophylla</i>	black titi	X		X		X
<i>Cnidoscolus stimulosus</i>	tread softly				X	
<i>Croptilon divaricatum</i>	slender scratchdaisy				X	
<i>Ctenium aromaticum</i>	toothache grass		X	X		
<i>Cyperus lanceolatus</i>	epiphytic flatsedge	X				
<i>Cyrilla racemiflora</i>	titi	X				X
<i>Dalea pinnata</i>	summer farewell				X	
<i>Dichantherium acuminatum</i>	tapered witchgrass			X	X	
<i>Dichantherium ensifolium</i>	cypress witchgrass				X	
<i>Dichantherium</i> sp.	witchgrass		X	X		
<i>Diospyros virginiana</i>	common persimmon			X	X	

Scientific Name	Common Name	Bay Swamp	High Pine	Hydric Savanna	Sandhill	Stream Swamp
<i>Drosera capillaris</i>	pink sundew	X		X		
<i>Elephantopus elatus</i>	tall elephantsfoot		X			
<i>Eragrostis pectinacea</i>	tufted lovegrass				X	
<i>Eriocaulon decangulare</i>	tenangle pipewort			X		
<i>Eriogonum tomentosum</i>	dogtongue wild buckwheat				X	
<i>Eryngium yuccifolium</i>	button rattlesnakemaster			X		
<i>Eupatorium compositifolium</i>	yankeeweed		X		X	
<i>Eupatorium rotundifolium</i>	roundleaf thoroughwort			X		
<i>Eurybia eryngiifolia</i>	thistleleaf aster		X			
<i>Euthamia caroliniana</i>	slender flattop goldenrod			X		
<i>Fuirena breviseta</i>	saltmarsh umbrellasedge			X		
<i>Galactia volubilis</i>	downy milkpea				X	
<i>Gaylussacia dumosa</i>	dwarf huckleberry		X	X	X	
<i>Gelsemium sempervirens</i>	yellow jessamine		X			
<i>Gymnopogon ambiguus</i>	bearded skeletongrass				X	
<i>Helianthus angustifolius</i>	narrowleaf sunflower		X	X		
<i>Helianthus radula</i>	stiff sunflower		X		X	
<i>Hypericum fasciculatum</i>	peelbark St. John's wort	X				
<i>Hypericum gentianoides</i>	orangegrass				X	
<i>Hypericum hypericoides</i>	St. Andrew's cross				X	
<i>Hypericum tetrapetalum</i>	fourpetal St. John's wort	X	X	X		
<i>Ilex cassine</i>	dahoon	X		X		
<i>Ilex coriacea</i>	large gallberry	X	X	X		X
<i>Ilex glabra</i>	gallberry		X	X	X	
<i>Ilex opaca</i>	American holly					X
<i>Ilex vomitoria</i>	yaupon		X	X	X	
<i>Lachnocaulon anceps</i>	whitehead bogbutton		X	X	X	
<i>Lechea sessiliflora</i>	pineland pinweed				X	
<i>Leucothoe axillaris</i>	coastal doghobble					X
<i>Leucothoe racemosa</i>	swamp doghobble					X
<i>Liatris chapmanii</i>	Chapman's gayfeather				X	
<i>Liatris elegans</i>	pinkscale gayfeather				X	
<i>Liatris gracilis</i>	slender gayfeather		X		X	
<i>Liatris pauciflora</i> var. <i>secunda</i>	Piedmont gayfeather				X	
<i>Liatris spicata</i>	dense gayfeather		X		X	
<i>Liatris tenuifolia</i>	shortleaf gayfeather		X		X	
<i>Licania michauxii</i>	gopher apple				X	
<i>Liriodendron tulipifera</i>	tuliptree	X				X
<i>Lobelia brevifolia</i>	shortleaf lobelia		X	X		
<i>Lobelia glandulosa</i>	glade lobelia			X		
<i>Lophiola aurea</i>	golden crest			X		
<i>Ludwigia leptocarpa</i>	anglestem primrosewillow				X	
<i>Lupinus diffusus</i>	skyblue lupine				X	
<i>Lycopodiella alopecuroides</i>	foxtail club-moss		X	X		
<i>Lycopodiella appressa</i>	southern club-moss	X				
<i>Lyonia lucida</i>	fetterbush	X		X		X

Scientific Name	Common Name	Bay Swamp	High Pine	Hydric Savanna	Sandhill	Stream Swamp
<i>Magnolia grandiflora</i>	southern magnolia		X			
<i>Magnolia virginiana</i>	sweetbay	X	X	X		X
<i>Mimosa quadrivalvis</i>	sensitive briar				X	
<i>Myrica caroliniensis</i>	evergreen bayberry	X				
<i>Myrica inodora</i>	odorless bayberry					X
<i>Nyssa sylvatica</i>	blackgum	X				X
<i>Nyssa sylvatica</i> var. <i>biflora</i>	swamp tupelo	X				X
<i>Opuntia humifusa</i>	pricklypear		X		X	
<i>Osmanthus americanus</i>	wild olive				X	
<i>Osmunda cinnamomea</i>	cinnamon fern	X		X		X
<i>Osmunda regalis</i> var. <i>spectabilis</i>	royal fern	X				
<i>Panicum repens</i>	torpedo grass			X		
<i>Panicum verrucosum</i>	warty panicgrass			X		
<i>Panicum virgatum</i>	switchgrass			X	X	
<i>Paronychia patula</i>	pineland nailwort				X	
<i>Peltandra</i> sp.		X				
<i>Persea palustris</i>	swamp bay	X				X
<i>Photinia pyrifolia</i>	red chokeberry			X		
<i>Pinus clausa</i>	sand pine				X	
<i>Pinus elliottii</i>	slash pine	X	X	X	X	X
<i>Pinus palustris</i>	longleaf pine				X	X
<i>Pinus serotina</i>	pond pine	X		X		
<i>Pityopsis graminifolia</i>	narrowleaf silkgrass		X		X	
<i>Polygonella gracilis</i>	tall jointweed				X	
<i>Pteridium aquilinum</i>	bracken fern		X	X		
<i>Pterocaulon pycnostachyum</i>	blackroot		X			
<i>Quercus falcata</i>	southern red oak				X	
<i>Quercus geminata</i>	sand live oak		X		X	
<i>Quercus hemisphaerica</i>	laurel oak				X	
<i>Quercus incana</i>	bluejack oak				X	
<i>Quercus laevis</i>	turkey oak				X	
<i>Quercus margarettae</i>	sand post oak				X	
<i>Quercus myrtifolia</i>	myrtle oak				X	
<i>Quercus nigra</i>	water oak	X				X
<i>Quercus pumila</i>	runner oak		X			
<i>Rhexia alifanus</i>	savannah meadowbeauty		X	X		
<i>Rhododendron canescens</i>	mountain azalea	X				X
<i>Rhus copallinum</i>	winged sumac				X	
<i>Rhynchospora baldwinii</i>	Baldwin's beaksedge		X			
<i>Rhynchospora chalarocephala</i>	loosehead beaksedge			X		
<i>Rhynchospora chapmanii</i>	Chapman's beaksedge			X		
<i>Rhynchospora ciliaris</i>	fringed beaksedge			X		
<i>Rhynchospora fascicularis</i>	fascicled beaksedge			X		
<i>Rhynchospora gracilentia</i>	slender beaksedge			X		
<i>Rhynchospora megalocarpa</i>	sandyfield beaksedge				X	
<i>Rhynchospora</i> sp.	beaksedge			X		

Scientific Name	Common Name	Bay Swamp	High Pine	Hydric Savanna	Sandhill	Stream Swamp
<i>Rubus cuneifolius</i>	sand blackberry				X	
<i>Sabatia brevifolia</i>	shortleaf rosegentian		X			
<i>Saccharum giganteum</i>	sugarcane plumegrass	X				
<i>Salvia azurea</i>	azure blue sage		X			
<i>Salvia coccinea</i>	blood sage				X	
<i>Sarracenia leucophylla</i>	white-top pitcherplant			X		
<i>Sassafras albidum</i>	sassafras				X	
<i>Schizachyrium scoparium</i>	little bluestem			X	X	
<i>Serenoa repens</i>	saw palmetto	X	X	X	X	
<i>Sericocarpus tortifolius</i>	whiteworm aster		X	X		
<i>Seymeria cassioides</i>	yaupon blackberry		X			
<i>Smilax auriculata</i>	earleaf greenbrier				X	
<i>Smilax glauca</i>	cat greenbrier		X	X		
<i>Smilax laurifolia</i>	laurel greenbrier	X		X		
<i>Solidago fistulosa</i>	pinebarren goldenrod	X				
<i>Solidago odora</i>	sweet goldenrod		X	X	X	
<i>Sorghastrum ellipticum</i>	slender indiangrass				X	
<i>Sorghastrum nutans</i>	yellow indiangrass		X			
<i>Sphagnum</i> sp.	sphagnum moss					X
<i>Sporobolus floridanus</i>	Florida dropseed		X			
<i>Sporobolus junceus</i>	pineywoods dropseed				X	
<i>Stillingia sylvatica</i>	queen's delight				X	
<i>Symphotrichum adnatum</i>	scaleleaf aster		X		X	
<i>Symphotrichum dumosum</i>	rice button aster		X		X	
<i>Symphotrichum patens</i>	late purple aster				X	
<i>Taxodium ascendens</i>	pond cypress					X
<i>Tephrosia virginiana</i>	goat's rue				X	
<i>Tragia</i> sp.	noseburn		X		X	
unknown grass	unknown grass				X	
<i>Utricularia juncea</i>	southern bladderwort			X		
<i>Utricularia subulata</i>	zigzag bladderwort			X		
<i>Vaccinium arboreum</i>	sparkleberry				X	
<i>Vaccinium myrsinites</i>	shiny blueberry		X	X	X	
<i>Viburnum nudum</i>	possumhaw	X				
<i>Viola lanceolata</i>	bog white violet			X		
<i>Vitis rotundifolia</i>	muscadine		X		X	
<i>Woodwardia areolata</i>	netted chain fern	X				X
<i>Woodwardia virginica</i>	Virginia chain fern		X			
<i>Xyris caroliniana</i>	Carolina yellow-eyed grass		X	X		
<i>Xyris stricta</i>	pineland yellow-eyed grass		X			
<i>Yucca filamentosa</i>	Adam's needle		X		X	
Grand Total=177		35	56	67	82	23

Figure 2. Percent species cover in Sandhill Transect 1.

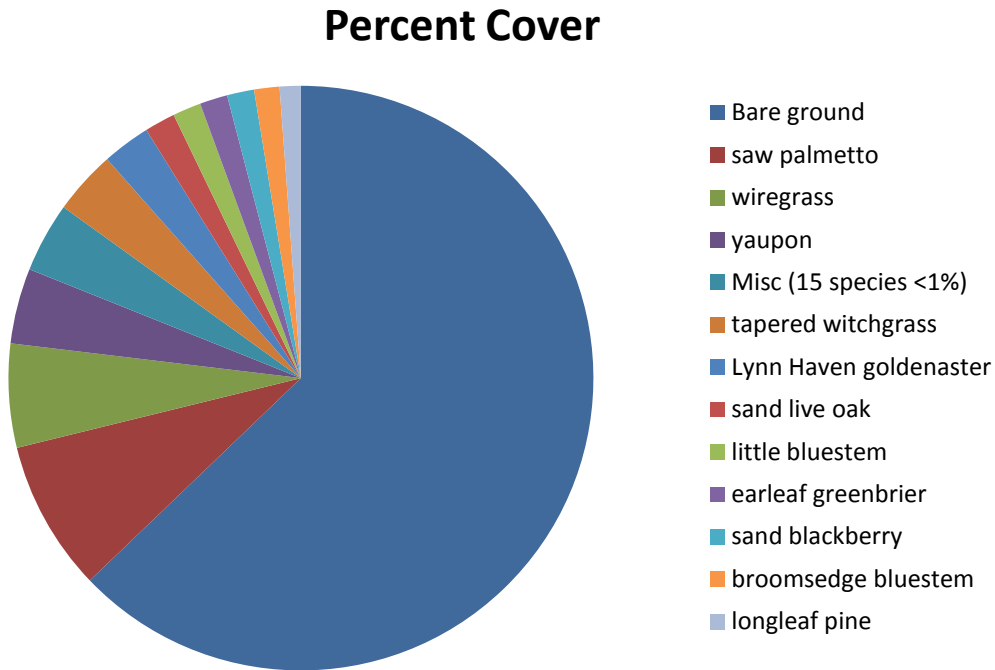


Table 2. Percent species cover in Sandhill Transect 1 (sampled on 11/06/12).

Scientific name	Common name	Average percent cover per quadrat
<i>Andropogon virginicus</i>	broomsedge bluestem	1.40
<i>Aristida purpurascens</i>	arrowfeather threeawn	0.20
<i>Aristida stricta</i> var. <i>beyrichiana</i>	wiregrass	5.73
<i>Bulbostylis ciliatifolia</i>	capillary hairsedge	0.07
<i>Chrysopsis lanuginosa</i>	Lynn Haven goldenaster	2.67
<i>Croptilon divaricatum</i>	slender scratchdaisy	0.03
<i>Dichantherium acuminatum</i>	tapered witchgrass	3.53
<i>Eupatorium compositifolium</i>	yankeeweed	0.33
<i>Hypericum gentianoides</i>	orangegrass	0.57
<i>Ilex vomitoria</i>	yaupon	4.17
<i>Liatris secunda</i>	Piedmont gayfeather	0.27
<i>Liatris tenuifolia</i>	shortleaf gayfeather	0.03
<i>Licania michauxii</i>	gopher apple	0.47
<i>Ludwigia leptocarpa</i>	anglestem primrosewillow	0.50
<i>Lupinus diffusus</i>	skyblue lupine	0.23
<i>Pinus palustris</i> -bolting	longleaf pine	1.17
<i>Pinus palustris</i> -grass stage	longleaf pine	0.50
<i>Pityopsis graminifolia</i>	narrowleaf silkgrass	0.23
<i>Polygonella gracilis</i>	tall jointweed	0.03
<i>Quercus geminata</i>	sand live oak	1.70
<i>Rubus cuneifolius</i>	sand blackberry	1.50

Scientific name	Common name	Average percent cover per quadrat
<i>Schizachyrium scoparium</i>	little bluestem	1.57
<i>Serenoa repens</i>	saw palmetto	8.33
<i>Smilax auriculata</i>	earleaf greenbrier	1.53
<i>Solidago odora</i>	sweet goldenrod	0.07
unknown grass	unknown grass	0.33
	Bare ground	62.83

Figure 3. Percent species cover in Sandhill Transect 2.

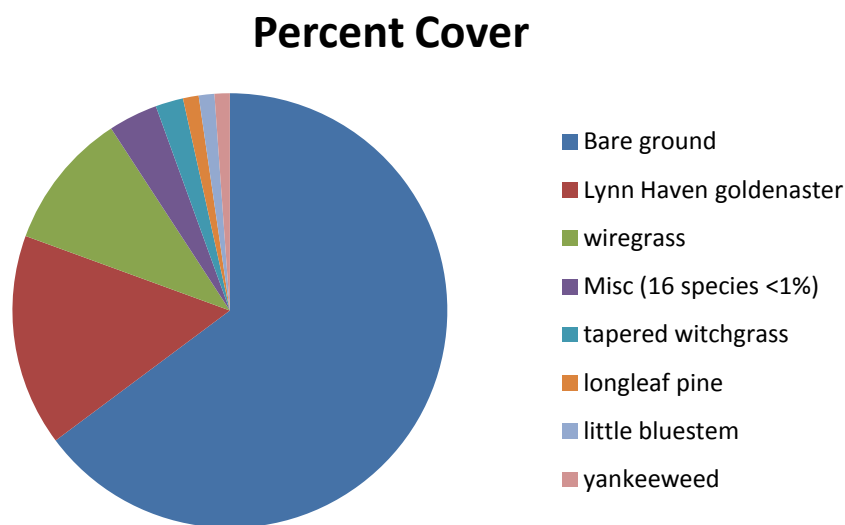


Table 3. Percent species cover in Sandhill Transect 2 (sampled on 11/09/12).

Scientific name	Common name	Average percent cover per quadrat
<i>Andropogon virginicus</i>	broomsedge bluestem	0.50
<i>Aristida purpurascens</i>	arrowfeather threeawn	0.27
<i>Aristida stricta</i> var. <i>beyrichiana</i>	wiregrass	10.23
<i>Bulbostylis ciliatifolia</i>	capillary hairsedge	0.27
<i>Chrysopsis lanuginosa</i>	Lynn Haven goldenaster	15.77
<i>Dichanthelium acuminatum</i>	tapered witchgrass	2.07
<i>Eriogonum tomentosum</i>	dogtongue wild buckwheat	0.27
<i>Eupatorium compositifolium</i>	yankeeweed	1.13
<i>Galactia volubilis</i>	downy milkpea	0.03
<i>Gaylussacia dumosa</i>	dwarf huckleberry	0.13
<i>Hypericum gentianoides</i>	orangegrass	0.03
<i>Hypericum hypericoides</i>	St. Andrew's cross	0.50
<i>Liatris secunda</i>	Piedmont gayfeather	0.17
<i>Mimosa quadrivalvis</i>	sensitive briar	0.03
<i>Opuntia humifusa</i>	pricklypear	0.03

Scientific name	Common name	Average percent cover per quadrat
<i>Pinus palustris-bolting</i>	longleaf pine	1.17
<i>Polygonella gracilis</i>	tall jointweed	0.13
<i>Quercus geminata</i>	sand live oak	0.03
<i>Quercus hemisphaerica-not rooted</i>	laurel oak	0.50
<i>Quercus laevis-not rooted</i>	turkey oak	0.23
<i>Schizachyrium scoparium</i>	little bluestem	1.17
<i>Smilax auriculata</i>	earleaf greenbrier	0.53
	Bare ground	64.80

Hydric Savanna

Qualitative sampling. At the time of sampling the soil was moist with seepy areas present. The area of Transect 1 had previously been gyro-tracked and was sparsely vegetated with much disturbed bare ground present. Whitetop pitcher-plant and beaksedges were found in the seepage areas and a wide variety of herbs including wiregrass was found in the rest of the area. In the area of transect 2 a dense stand of black titi had been burned and incompletely herbicided. Seepage areas here had the same species as in the previous area and the remaining portion consisted of either dense titi or open areas with wiregrass and scattered pond pines. The total number of species observed in this community was 67 (Table 1).

Quantitative sampling. Transect 1 (Table 4, Figure 4) had a total of 31 species and a total species cover of 18%. The highest percent cover was by miscellaneous species with less than 1% cover (7%), followed by wiregrass and large gallberry. A small amount of the invasive exotic, torpedo grass, was seen in this transect but was not observed in other portions of this community. Transect 2 (Table 5, Figure 5) had a total of 28 species and a total species cover of 34%. Wiregrass made up the highest percentage cover (9%), followed by large gallberry and black titi.

Figure 4. Percent species cover in Hydric Savanna Transect 1.

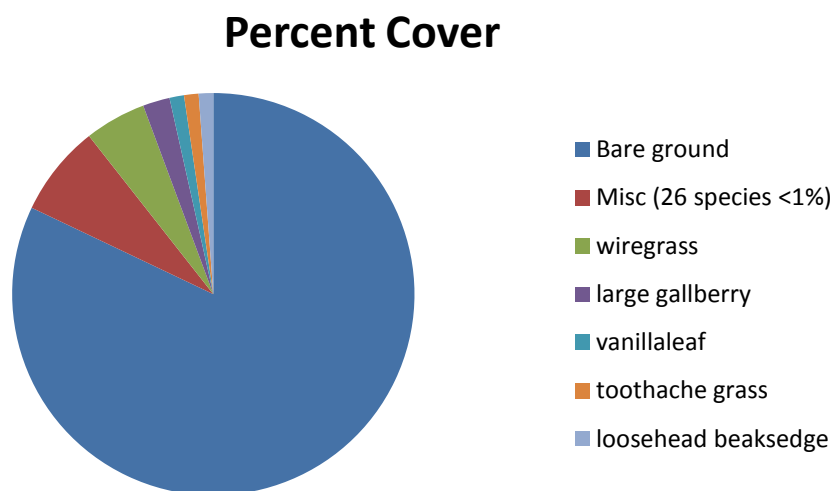


Table 4. Percent species cover in Hydric Savanna Transect 1 (sampled on 11/07/12).

Scientific name	Common name	Average percent cover per quadrat
<i>Andropogon glomeratus</i>	bushy bluestem	0.60
<i>Andropogon glomeratus</i> var. <i>glaucoptis</i>	purple bluestem	0.60
<i>Andropogon virginicus</i>	broomsedge bluestem	0.10
<i>Anthraenantia villosa</i>	green silkyscale	0.03
<i>Aristida stricta</i> var. <i>beyrichiana</i>	wiregrass	4.93
<i>Arundinaria gigantea</i>	switchcane	0.03
<i>Carphephorus odoratissimus</i>	vanillaleaf	1.17
<i>Carphephorus pseudoliatris</i>	bristleleaf chaffhead	0.63
<i>Clethra alnifolia</i>	sweet pepperbush	0.50
<i>Cliftonia monophylla</i>	black titi	0.73
<i>Ctenium aromaticum</i>	toothache grass	1.17
<i>Dichanthelium acuminatum</i>	tapered witchgrass	0.70
<i>Eriocaulon decangulare</i>	tenangle pipewort	0.33
<i>Gaylussacia dumosa</i>	dwarf huckleberry	0.23
<i>Ilex coriacea</i>	large gallberry	2.17
<i>Ilex glabra</i>	gallberry	0.50
<i>Ilex vomitoria</i>	yaupon	0.27
<i>Lachnocaulon anceps</i>	whitehead bogbutton	0.03
<i>Lophiola aurea</i>	golden crest	0.10
<i>Lycopodiella alopecuroides</i>	foxtail club-moss	0.10
<i>Panicum repens</i>	torpedo grass	0.03
<i>Photinia pyrifolia</i>	red chokeberry	0.10
<i>Pteridium aquilinum</i>	bracken fern	0.10
<i>Rhexia alifanus</i>	savannah meadowbeauty	0.07
<i>Rhynchospora chalarocephala</i>	loosehead beaksedge	1.17
<i>Rhynchospora chapmanii</i>	Chapman's beaksedge	0.23
<i>Rhynchospora ciliaris</i>	fringed beaksedge	0.17
<i>Sarracenia leucophylla</i>	white-top pitcherplant	0.50
<i>Schizachyrium scoparium</i>	little bluestem	0.10
<i>Smilax glauca</i>	cat greenbrier	0.50
<i>Xyris caroliniana</i>	Carolina yellow-eyed grass	0.03
	Bare ground	82.07

Figure 5. Percent species cover in Hydric Savanna Transect 2.

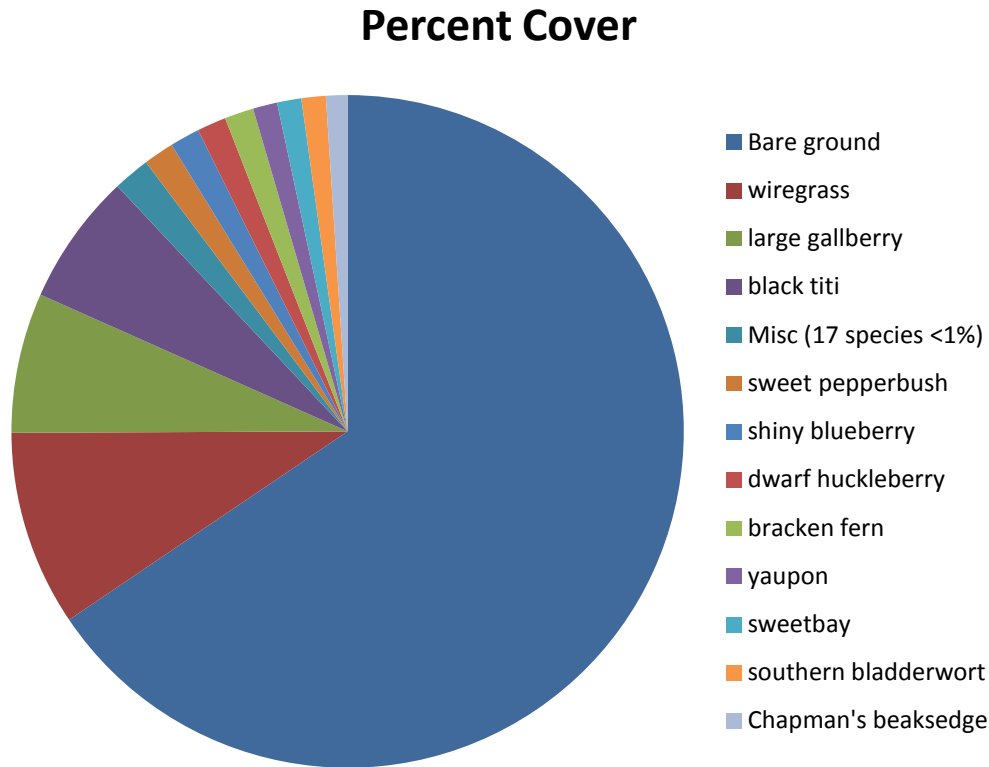


Table 5. Percent species cover in Hydric Savanna Transect 2 (sampled on 11/08/12).

Scientific name	Common name	Average percent cover per quadrat
<i>Andropogon sp.</i>	bluestem	0.10
<i>Aristida stricta</i> var. <i>beyrichiana</i>	wiregrass	9.40
<i>Carphephorus pseudoliatris</i>	bristleleaf chaffhead	0.03
<i>Clethra alnifolia</i>	sweet pepperbush	1.47
<i>Cliftonia monophylla</i>	black titi	6.33
<i>Dichantheium acuminatum</i>	tapered witchgrass	0.13
<i>Dichantheium sp.</i>	witchgrass	0.23
<i>Diospyros virginiana</i>	common persimmon	0.50
<i>Drosera capillaris</i>	pink sundew	0.03
<i>Eriocaulon decangulare</i>	tenangle pipewort	0.03
<i>Gaylussacia dumosa</i>	dwarf huckleberry	1.40
<i>Ilex coriacea</i>	large gallberry	6.73
<i>Ilex vomitoria</i>	yaupon	1.17
<i>Lyonia lucida</i>	fetterbush	0.10
<i>Magnolia virginiana</i>	sweetbay	1.17
<i>Panicum virgatum</i>	switchgrass	0.03
<i>Pinus serotina</i> -seedling	pond pine	0.03
<i>Pteridium aquilinum</i>	bracken fern	1.40

Scientific name	Common name	Average percent cover per quadrat
<i>Rhynchospora chapmanii</i>	Chapman's beaksedge	1.03
<i>Rhynchospora ciliaris</i>	fringed beaksedge	0.07
<i>Rhynchospora</i> sp.	beaksedge	0.10
<i>Sarracenia leucophylla</i>	white-top pitcherplant	0.10
<i>Serenoa repens</i> -seedling	saw palmetto	0.03
<i>Smilax glauca</i>	cat greenbrier	0.10
<i>Smilax laurifolia</i>	laurel greenbrier	0.10
<i>Utricularia juncea</i>	southern bladderwort	1.17
<i>Vaccinium myrsinites</i>	shiny blueberry	1.43
<i>Xyris caroliniana</i>	Carolina yellow-eyed grass	0.03
	Bare ground	65.53

High Pine

Qualitative sampling. At the time of sampling the areas targeted for restoration to high pine were dry. Portions of this area had a canopy of slash pine making up 20-30% cover and a dense low shrub layer of gallberry and yaupon covering 70-80% of the area with scattered small patches of wiregrass. Other portions were more open with larger patches of wiregrass with scattered shrubs of saw palmetto and yaupon. These more open areas had more of such typical flatwoods herbs as scaleleaf aster, thistleleaf aster, shortleaf gayfeather, shortleaf lobelia, and vanillaleaf. The total number of species observed in this community was 56 (Table 1).

Bay Swamp

Qualitative sampling. This natural community occurs along smaller streams tributary to Lafayette Creek. At the time of sampling the soils were saturated and the streams were running. The dense canopy is formed by evergreen broadleaf trees, sweetbay, black titi, and swamp bay, plus pond pine. The shrub layer is also largely evergreen with fetterbush and wax myrtle common and hazel alder and mountain azalea occasional. The herb layer is sparse or absent. The total number of species observed in this community was 35 (Table 1).

Stream Swamp

Qualitative sampling. This natural community occurred along Lafayette Creek and its major tributary, Wolf Creek. Soils at the time of sampling were dry to saturated. The closed canopy was composed of blackgum and sweetbay with occasional slash pines, and the sparse to relatively dense subcanopy consisted of titi, black titi, and fetterbush. Sphagnum moss was the main ground cover. The total number of species observed in this community was 23 (Table 1).

A total of 177 native species were observed during the November 6-8, 2012 monitoring period over all the target communities at Lafayette Creek – Phase I, of which 44 had not been previously recorded during an April 2011 survey (Cardno Entrix 2011). Many of these were fall-flowering grasses and asters which would not have been identifiable during a spring survey.

References

Cardno Entrix. 2011. Lafayette Creek Property – Phases I and II. Umbrella Regional Mitigation Plans for Florida Department of Transportation Projects Conceptual Mitigation Plan, Walton County, Florida. Cardno Entrix, Tallahassee, FL.

Plum Creek at Holmes Creek Mitigation Site
Qualitative and Quantitative Monitoring
December 2012

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Qualitative and Quantitative Monitoring
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Introduction

The Plum Creek at Holmes Creek Mitigation Site compensates for the loss of wetland function due to the impact of the SR 79 Open Creek Bridge in Washington County, Florida. It consists of a 130-acre tract north of Holmes Creek that is contiguous with other Northwest Florida Water Management District holdings on its southern border. It can be accessed via Johnson Road which heads east from SR 79, 6.3 miles south of its junction with I-10. The Plum Creek Mitigation project aims to restore areas formerly in pine plantation to sandhill (SA), and a former beaver pond to mixed forested wetlands (MFW). Quantitative and qualitative monitoring documents the current plant species composition and vegetation structure of the communities targeted for restoration as well as that of an intact mixed forested wetland community.

Methods

The 2012 quantitative monitoring consisted of staking the endpoints of four 300-ft permanent transect lines in polygons of communities to be restored: two in the sandhill; one in mixed forested wetland (restored) and one (a control) in mixed forested wetland (preserved; Figure 1). Percent cover of each species was estimated in meter square quadrats set every 20 feet along each transect (including the 0 point), totaling 15 quadrats per transect. Qualitative monitoring consisted of walking through the polygons and noting the species and vegetation structure for the three communities.

Results

Sandhill

Qualitative sampling. At time of sampling, the clayey sand soils of the area with the target community of sandhill were dry. Most of the cover on the gentle to steep sandy slopes consisted of a diverse set of grasses and forbs plus bare ground with scattered patches of small trees and shrubs that were thick in places. Planted longleaf pine in seedling stage was present. Grasses included occasional wiregrass with broomsedge bluestem, little bluestem, and needleleaf witchgrass. Although native weedy species, such as orangegrass, currently predominate among the herbs, many typical sandhill species were present to provide a seed source as the fire regime returns to a more natural frequency. Shrubs and trees included yaupon holly, sand live oak, sparkleberry, and laurel oak, as well as lesser amounts of the more typical sandhill trees, sand post oak and turkey oak. The weedy earleaf greenbrier and yellow jessamine vines were common in the shrub patches. The total number of species observed in this community was 38 (Table 1). Five active gopher tortoise burrows were noted in the course of the survey of this community.

Quantitative sampling. Transect 1 (Table 2, Figure 2) had a total of 24 species and a total species cover of 29%. The highest percent cover was by orangegrass (8%), followed by yellow jessamine, laurel oak, wiregrass, and earleaf greenbrier. Transect 2 (Table 3, Figure 3) had a total of 27 species and a total species cover of 43%. Yaupon had the highest percent cover (13%), followed by orangegrass, earleaf greenbrier, yellow jessamine, sparkleberry, and sand post oak. An indication of high species diversity at both transects is the relatively high total percentage cover of the “miscellaneous species with less than 1% cover” category.

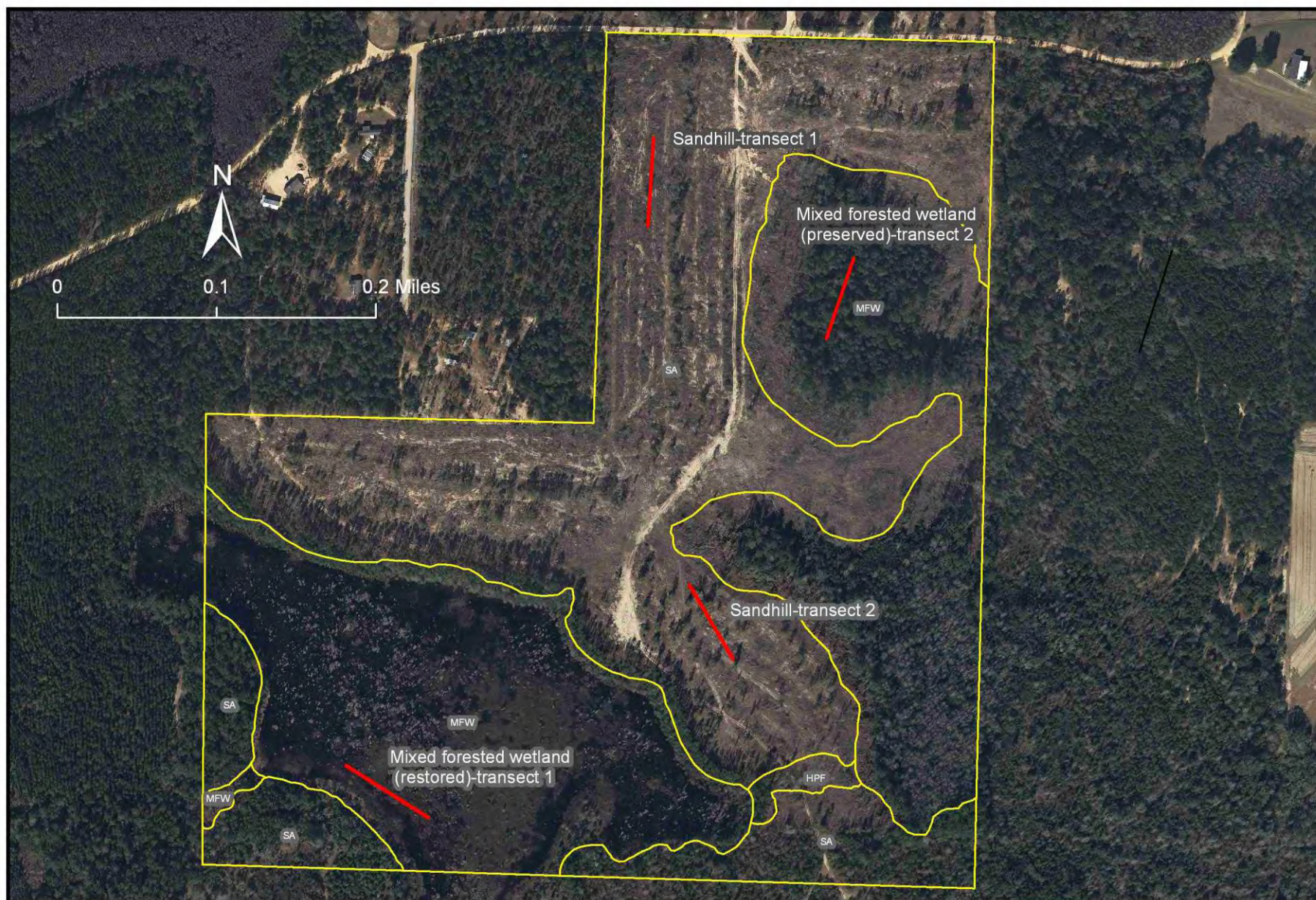


Figure 1. Location of permanent transects at Plum Creek at Holmes Creek Mitigation Site. SA=Sandhill, MFW=Mixed Forested Wetland, HPF=Hydric Pine Flatwoods.

Table 1. Species observed in target communities at Plum Creek at Holmes Creek Mitigation Site, November 15-16, 2012.

Scientific Name	Common Name	Sandhill	Mixed Forested Wetland (restored)	Mixed Forested Wetland (preserved)
<i>Acer rubrum</i>	red maple		X	
<i>Agalinis fasciculata</i>	beach false foxglove	X		
<i>Ambrosia artemisiifolia</i>	common ragweed	X		
<i>Andropogon glomeratus</i> var. <i>glaucoptis</i>	purple bluestem	X	X	
<i>Andropogon ternarius</i>	splitbeard bluestem	X		
<i>Andropogon virginicus</i>	broomsedge bluestem	X	X	
<i>Apteria aphylla</i>	nodding nixie			X
<i>Aristida purpurascens</i>	arrowfeather threeawn	X		
<i>Aristida stricta</i> var. <i>beyrichiana</i>	wiregrass	X		
<i>Baptisia lanceolata</i>	gopherweed	X		
<i>Berlandiera pumila</i>	soft greeneyes	X		
<i>Bidens mitis</i>	smallfruit beggarticks		X	
<i>Bulbostylis ciliatifolia</i>	capillary hairsedge	X		
<i>Callicarpa americana</i>	American beautyberry	X		
<i>Carex glaucescens</i>	clustered sedge			X
<i>Carex</i> sp.	sedge			X
<i>Chamaecrista fasciculata</i>	partridge pea	X		
<i>Chrysoma pauciflosculosa</i>	woody goldenrod	X		
<i>Chrysopsis lanuginosa</i>	Lynn Haven goldenaster	X		
<i>Cladina evansii</i>	a lichen	X		
<i>Clethra alnifolia</i>	sweet pepperbush		X	X
<i>Cliftonia monophylla</i>	black titi			X
<i>Cnidioscolus stimulosus</i>	tread softly	X		
<i>Conyza canadensis</i>	Canadian horseweed	X		
<i>Cornus florida</i>	flowering dogwood	X		
<i>Croptilon divaricatum</i>	slender scratchdaisy	X		
<i>Croton glandulosus</i>	vente conmigo	X		
<i>Cyperus retrorsus</i>	pinebarren flatsedge	X		
<i>Cyrilla racemiflora</i>	titi		X	X
<i>Dalea pinnata</i>	summer farewell	X		
<i>Decodon verticillatus</i>	willow herb		X	
<i>Dichantheium aciculare</i>	needleleaf witchgrass	X		
<i>Dichantheium commutatum</i>	variable witchgrass	X		
<i>Diospyros virginiana</i>	common persimmon	X		
<i>Dulichium arundinaceum</i>	threeway sedge		X	
<i>Eleocharis equisetoides</i>	jointed spikerush		X	
<i>Eragrostis spectabilis</i>	purple lovegrass	X		
<i>Eriogonum tomentosum</i>	dogtongue wild buckwheat	X		
<i>Eupatorium capillifolium</i>	dogfennel		X	
<i>Eupatorium compositifolium</i>	yankeeweeds	X		
<i>Eupatorium mohrii</i>	Mohr's thoroughwort	X		
<i>Eupatorium</i> sp.	thoroughwort		X	

Scientific Name	Common Name	Sandhill	Mixed Forested Wetland (restored)	Mixed Forested Wetland (preserved)
<i>Euthamia caroliniana</i>	slender flattop goldenrod	X		
<i>Gelsemium sempervirens</i>	yellow jessamine	X		
<i>Gymnopogon ambiguus</i>	bearded skeletongrass	X		
<i>Helianthemum corymbosum</i>	pinebarren frostweed	X		
<i>Hypericum gentianoides</i>	orangegrass	X		
<i>Hypericum hypericoides</i>	St. Andrew's cross	X		
<i>Hypericum</i> sp.	St. John's wort		X	
<i>Hypericum tetrapetalum</i>	fourpetal St. John's wort	X		
<i>Ilex coriacea</i>	large gallberry			X
<i>Ilex glabra</i>	gallberry		X	
<i>Ilex opaca</i>	American holly	X		
<i>Ilex vomitoria</i>	yaupon	X		
<i>Juncus canadensis</i>	Canadian rush		X	
<i>Lachnanthes caroliniana</i>	Carolina redroot		X	
<i>Lechea minor</i>	thymeleaf pinweed	X		
<i>Lechea sessiliflora</i>	pineland pinweed	X		
<i>Leucothoe racemosa</i>	swamp doghobble			X
<i>Liatris elegans</i>	pinkscale gayfeather	X		
<i>Liatris gracilis</i>	slender gayfeather	X		
<i>Licania michauxii</i>	gopher apple	X		
<i>Ludwigia erecta</i>	Yerba de Jicotea		X	
<i>Ludwigia leptocarpa</i>	anglestem primrosewillow		X	
<i>Ludwigia</i> sp.	primrosewillow		X	
<i>Ludwigia suffruticosa</i>	shrubby primrosewillow		X	
<i>Lycopus rubellus</i>	taperleaf waterhorehound		X	
<i>Lyonia lucida</i>	fetterbush			X
<i>Magnolia virginiana</i>	sweetbay		X	X
<i>Myrica cerifera</i>	wax myrtle		X	X
<i>Myrica inodora</i>	odorless bayberry			X
<i>Nymphoides cordata</i>	little floatingheart		X	
<i>Nyssa sylvatica</i> var. <i>biflora</i>	swamp tupelo		X	X
<i>Osmanthus americanus</i>	wild olive	X		X
<i>Osmunda cinnamomea</i>	cinnamon fern			X
<i>Panicum anceps</i>	beaked panicum	X		
<i>Panicum hemitomom</i>	maidencane		X	
<i>Panicum verrucosum</i>	warty panicgrass		X	
<i>Panicum virgatum</i>	switchgrass	X		
<i>Paspalum setaceum</i>	thin paspalum	X		
<i>Persea palustris</i>	swamp bay			X
<i>Phytolacca americana</i>	American pokeweed	X		
<i>Pinus elliottii</i>	slash pine			X
<i>Pinus palustris</i>	longleaf pine	X		
<i>Pityopsis graminifolia</i>	narrowleaf silkgrass	X		
<i>Polypreum procumbens</i>	rustweed	X		

Scientific Name	Common Name	Sandhill	Mixed Forested Wetland (restored)	Mixed Forested Wetland (preserved)
<i>Pseudognaphalium obtusifolium</i>	sweet everlasting	X		
<i>Pteridium aquilinum</i>	bracken fern	X		
<i>Quercus falcata</i>	southern red oak	X		
<i>Quercus geminata</i>	sand live oak	X		
<i>Quercus hemisphaerica</i>	laurel oak	X		
<i>Quercus incana</i>	bluejack oak	X		
<i>Quercus laevis</i>	turkey oak	X		
<i>Quercus margarettae</i>	sand post oak	X		
<i>Rhynchosia cytisoides</i>	royal snoutbean	X		
<i>Rhynchosia reniformis</i>	dollarleaf	X		
<i>Rhynchospora chalarocephala</i>	loosehead beaksedge		X	X
<i>Rhynchospora nitens</i>	baldrush		X	
<i>Rhynchospora sp.</i>	beaksedge		X	
<i>Rubus cuneifolius</i>	sand blackberry	X		
<i>Schizachyrium scoparium</i>	little bluestem	X		
<i>Schizachyrium tenerum</i>	slender bluestem	X		
<i>Serenoa repens</i>	saw palmetto	X		
<i>Smilax auriculata</i>	earleaf greenbrier	X		
<i>Smilax glauca</i>	cat greenbrier	X		
<i>Smilax laurifolia</i>	laurel greenbrier			X
<i>Smilax pumila</i>	sarsaparilla vine	X		
<i>Smilax walteri</i>	coral greenbrier			X
<i>Solidago fistulosa</i>	pinebarren goldenrod		X	
<i>Solidago odora</i>	sweet goldenrod	X		
<i>Sorghastrum secundum</i>	lopsided indiagrass	X		
<i>Sphagnum sp.</i>	sphagnum moss			X
<i>Stillingia sylvatica</i>	queen's delight	X		
<i>Symphotrichum dumosum</i>	rice button aster	X		
<i>Taxodium ascendens</i>	pond cypress		X	
<i>Trichostema dichotomum</i>	forked bluecurls	X		
<i>Vaccinium arboreum</i>	sparkleberry	X		
<i>Vaccinium darrowii</i>	Darrow's blueberry	X		
<i>Vaccinium elliotii</i>	Elliott's blueberry	X		
<i>Vaccinium stamineum</i>	deerberry	X		
<i>Vitis rotundifolia</i>	muscadine	X		X
<i>Woodwardia areolata</i>	netted chain fern			X
<i>Xyris fimbriata</i>	fringed yellow-eyed grass		X	X
<i>Xyris sp.</i>	yellow-eyed grass		X	
<i>Yucca filamentosa</i>	Adam's needle	X		
Grand Total=125		79	34	24

Figure 2. Percent species cover in Sandhill Transect 1.

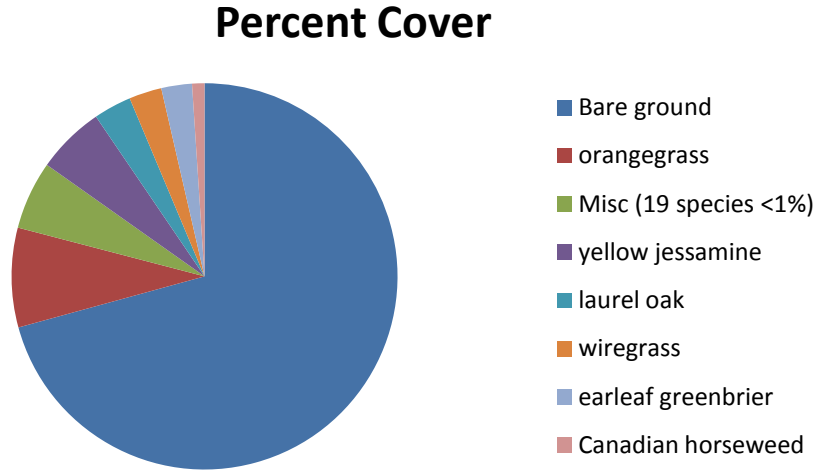


Table 2. Percent species cover in Sandhill Transect 1 (sampled on 11/15/12).

Scientific name	Common name	Average percent cover per quadrat
<i>Andropogon ternarius</i>	splitbeard bluestem	0.10
<i>Andropogon virginicus</i>	broomsedge bluestem	0.47
<i>Aristida purpurascens</i>	arrowfeather threeawn	0.33
<i>Aristida stricta</i> var. <i>beyrichiana</i>	wiregrass	2.73
<i>Chrysopsis lanuginosa</i>	Lynn Haven goldenaster	0.47
<i>Conyza canadensis</i>	Canadian horseweed	1.03
<i>Dichanthelium aciculare</i>	needleleaf witchgrass	0.70
<i>Dichanthelium commutatum</i>	variable witchgrass	0.60
<i>Eupatorium compositifolium</i>	yankeeweed	0.10
<i>Gelsemium sempervirens</i>	yellow jessamine	5.70
<i>Helianthemum corymbosum</i>	pinebarren frostweed	0.10
<i>Hypericum gentianoides</i>	orangegrass	8.33
<i>Liatris gracilis</i>	slender gayfeather	0.10
<i>Pinus palustris</i>	longleaf pine	0.73
<i>Pityopsis graminifolia</i>	narrowleaf silkgrass	0.23
<i>Polypremum procumbens</i>	rustweed	0.20
<i>Pseudognaphalium obtusifolium</i>	sweet everlasting	0.10
<i>Pteridium aquilinum</i>	bracken fern	0.53
<i>Quercus hemisphaerica</i>	laurel oak	3.17
<i>Rubus cuneifolius</i>	sand blackberry	0.03
<i>Serenoa repens</i>	saw palmetto	0.03
<i>Smilax auriculata</i>	earleaf greenbrier	2.57
<i>Smilax glauca</i>	cat greenbrier	0.43
<i>Solidago odora</i>	sweet goldenrod	0.23
<i>Vaccinium arboreum</i>	sparkleberry	0.23
	Bare ground	70.73

Figure 3. Percent species cover in Sandhill Transect 2.

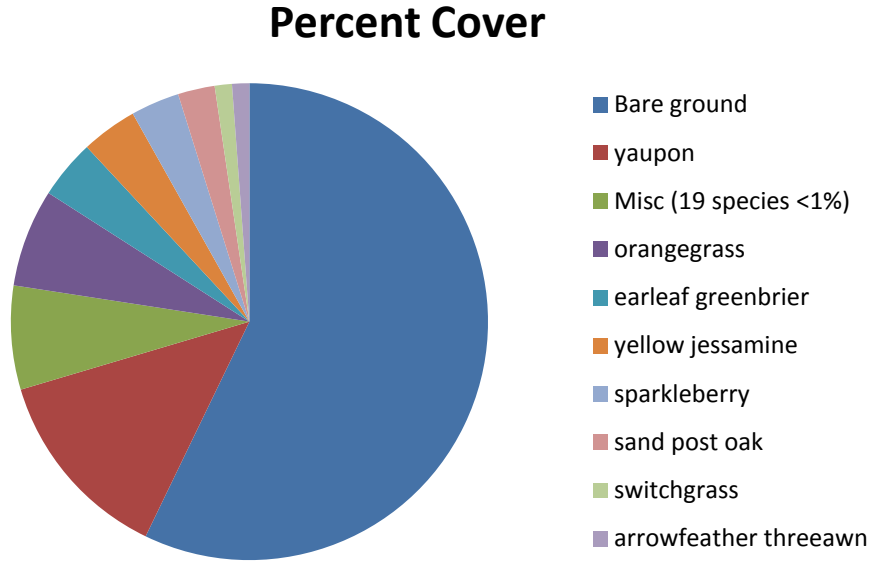


Table 3. Percent species cover in Sandhill Transect 2 (sampled on 11/16/12).

Scientific name	Common name	Average percent cover per quadrat
<i>Andropogon virginicus</i>	broomsedge bluestem	0.47
<i>Aristida purpurascens</i>	arrowfeather threeawn	1.17
<i>Baptisia lanceolata</i>	gopherweed	0.23
<i>Chrysopsis lanuginosa</i>	Lynn Haven goldenaster	0.20
<i>Conyza canadensis</i>	Canadian horseweed	0.83
<i>Croptilon divaricatum</i>	slender scratchdaisy	0.23
<i>Dalea pinnata</i>	summer farewell	0.50
<i>Dichanthelium aciculare</i>	needleleaf witchgrass	0.67
<i>Dichanthelium acuminatum</i>	tapered witchgrass	0.23
<i>Dichanthelium commutatum</i>	variable witchgrass	0.67
<i>Diospyros virginiana</i>	common persimmon	0.23
<i>Eriogonum tomentosum</i>	dogtongue wild buckwheat	0.23
<i>Gelsemium sempervirens</i>	yellow jessamine	3.80
<i>Hypericum gentianoides</i>	orangegrass	6.63
<i>Ilex vomitoria</i>	yaupon	13.23
<i>Panicum virgatum</i>	switchgrass	1.17
<i>Paspalum setaceum</i>	thin paspalum	0.23
<i>Pteridium aquilinum</i>	bracken fern	0.83
<i>Quercus margaretta</i>	sand post oak	2.50
<i>Rhus copallinum</i>	winged sumac	0.23
<i>Scleria ciliata</i>	fringed nutrush	0.23
<i>Scleria triglomerata</i>	whip nutrush	0.23

Scientific name	Common name	Average percent cover per quadrat
<i>Smilax auriculata</i>	earleaf greenbrier	4.00
<i>Smilax glauca</i>	cat greenbrier	0.43
<i>Smilax pumila</i>	sarsaparilla vine	0.10
<i>Solidago odora</i>	sweet goldenrod	0.23
<i>Vaccinium arboreum</i>	sparkleberry	3.30
	Bare ground	57.17

Mixed forested wetland (restored)

Qualitative sampling. At time of sampling, the soupy muck soils of the area of a former beaver pond with the target community of mixed forested wetland (Figure 1) were saturated along the edges with standing water toward the center. The vegetative cover consisted primarily of willow herb, a low shrub with woody base and herbaceous stems that arch over to form an impenetrable interlacing mass. Interspersed with the willow herb were patches of young cypress with occasional blackgum and red maple. Shallower areas near the shore were lined with a diverse set of wetland herbs, including taperleaf waterhorehound, maidencane, and jointed spikerush. The total number of species observed in this community was 33 (Table 1).

Quantitative sampling. Transect 1 (Table 4, Figure 4) had a total of 16 species and a total species cover of 91%. The highest percent cover was by willow herb with 55% followed by taperleaf waterhorehound, smallfruit beggarticks, and jointed spikerush.

Figure 4. Percent species cover in Mixed Forested Wetland (restored) Transect 1.

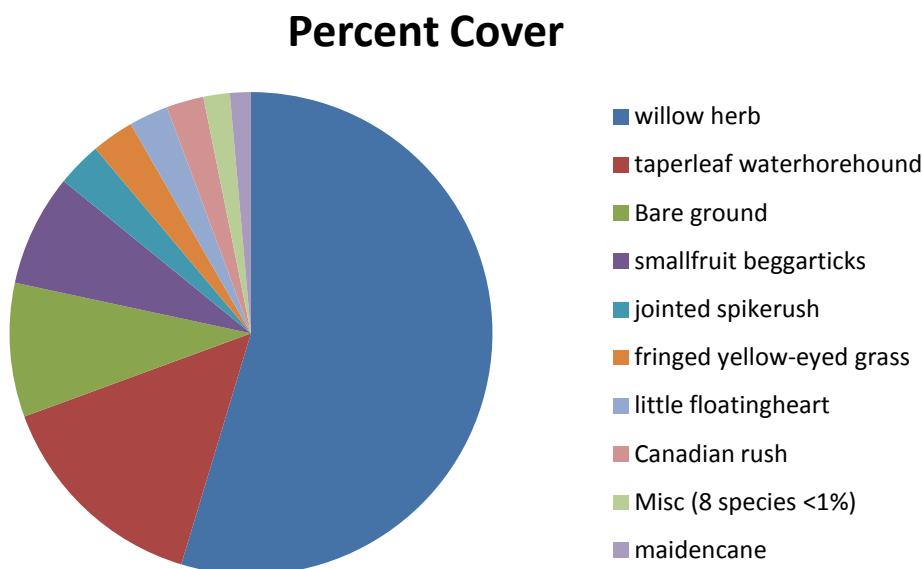


Table 4. Percent species cover in Mixed Forested Wetland (restored) Transect 1 (sampled on 11/15/12).

Scientific name	Common name	Average percent cover per quadrat
<i>Andropogon glomeratus</i> var. <i>glaucoptis</i>	purple bluestem	0.50
<i>Bidens mitis</i>	smallfruit beggarticks	7.50
<i>Decodon verticillatus</i>	willow herb	54.67
<i>Eleocharis equisetoides</i>	jointed spikerush	3.00
<i>Eupatorium capillifolium</i>	dogfennel	0.23
<i>Eupatorium</i> sp.	thoroughwort	0.13
<i>Juncus canadensis</i>	Canadian rush	2.50
<i>Ludwigia</i> sp.	primrosewillow	0.23
<i>Ludwigia suffruticosa</i>	shrubby primrosewillow	0.23
<i>Lycopus rubellus</i>	taperleaf waterhorehound	14.73
<i>Nymphoides cordata</i>	little floatingheart	2.63
<i>Panicum hemitomon</i>	maidencane	1.40
<i>Rhynchospora chalarocephala</i>	loosehead beaksedge	0.10
<i>Rhynchospora</i> sp.	beaksedge	0.10
<i>Xyris fimbriata</i>	fringed yellow-eyed grass	2.83
<i>Xyris</i> sp.	yellow-eyed grass	0.23
	Bare ground	8.97

Mixed forested wetland (preserved)

Qualitative sampling. At time of sampling, the muck soils of the preserved mixed forested wetland (Figure 1) community were moist with a few scattered areas of standing water in dips. The vegetative cover was a mature swamp forest with a canopy of large trees of sweetbay and blackgum, emergent over a denser subcanopy layer of tree-size black titi with scattered swamp bays, and a moderately dense shrub layer of large gallberry, sweet pepperbush, wild olive, and fetterbush. The herb layer is sparse to absent, consisting primarily of sphagnum moss in openings. The total number of species observed in this community was 24 (Table 1).

Quantitative sampling. Transect 2 (Table 5, Figure 5) had a total of 10 species and a total species cover of 27%. (NB: Species cover included ground layer species, tree trunks rooted in the quadrat, and shrubs shading the quadrat. Shading by canopy and subcanopy species was not included. Had the latter been included, cover would have been >100% in all the quadrats). The highest percent cover was by large gallberry (8%) followed by fetterbush, sweet pepperbush, sphagnum moss, and black titi.

Figure 5. Percent species cover in Mixed Forested Wetland (preserved) Transect 2.

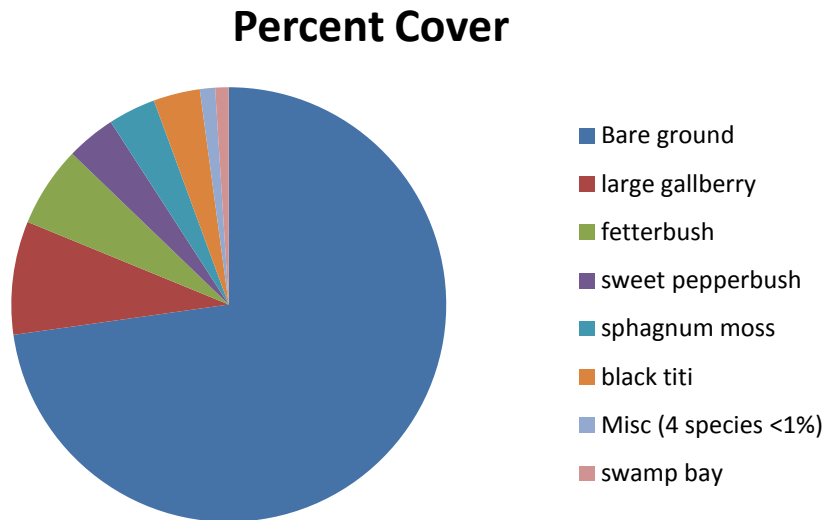


Table 5. Percent species cover in Mixed Forested Wetland (preserved) Transect 2 (sampled on 11/16/12).

Scientific name	Common name	Average percent cover per quadrat
<i>Apteria aphylla</i>	nodding nixie	0.03
<i>Carex</i> sp.	sedge	0.50
<i>Clethra alnifolia</i>	sweet pepperbush	3.67
<i>Cliftonia monophylla</i>	black titi	3.47
<i>Ilex coriacea</i>	large gallberry	8.43
<i>Lyonia lucida</i>	fetterbush	6.00
<i>Magnolia virginiana</i>	sweetbay	0.50
<i>Persea palustris</i>	swamp bay	1.00
<i>Smilax laurifolia</i>	laurel greenbrier	0.10
<i>Sphagnum</i> sp.	sphagnum moss	3.53
	Bare ground	72.77

A total of 125 native species were observed during the November 15-16 2012 monitoring period over all the target communities at Plum Creek at Holmes Creek Mitigation Site. Forty-six of these had not been previously recorded in during monitoring periods. Eight of the 46 were found only in the restored mixed forested wetland which was not monitored until the current year.

Ward Creek West Mitigation Site
Qualitative and Quantitative Monitoring
December 2012

Ward Creek West Mitigation Site Qualitative and Quantitative Monitoring December 2012

Introduction

The Ward Creek West Mitigation Site consists of 724 acres in Bay County managed by the Northwest Florida Water Management District. It is located 0.5 miles west of SR 79, 2.5 miles north of its junction with US 98. The Ward Creek West mitigation project aims to restore areas of former bedded slash pine plantation to hydric pine flatwoods (HPF) and hydric pine savanna (HPS), and portions of the mixed forested wetlands to cypress (CY; Figure 1). Quantitative and qualitative monitoring documents the current plant species composition and vegetation structure of communities targeted for restoration and enhancement.

Methods

The 2012 quantitative monitoring consisted of staking the endpoints of four 300-ft permanent transect lines in polygons of communities to be restored: two in the hydric pine flatwoods and two in hydric pine savanna (Figure 1). Percent cover of each species was estimated in meter square quadrats set every 20 feet along each transect (including the 0 point), totaling 15 quadrats per transect. Qualitative monitoring consisted of walking through the polygons and noting the species and vegetation structure for the three communities listed above, as well as for the portions of the mixed forested wetlands community designated to be converted to cypress.

Results

Hydric Pine Flatwoods

Qualitative sampling. At time of sampling, the area with the target community of hydric pine flatwoods was dry with some muddy areas where machinery used in thinning the pine plantation had disturbed the soil. The canopy of mature slash pines made up less than 5% cover and the ground layer was open with shrubs scattered throughout. Broomsedge bluestem and bushy bluestem along with beaksedges made up the herbaceous layer which covered from 5 to 20% of the area. Shrubs, primarily saw palmetto, titi and black titi, made up 50 to 75% of the ground cover, and the remaining area was taken up by woody debris left from the thinning operation. The total number of species observed in this community was 78 (Table 1).

Quantitative sampling. Transect 1 (Table 2, Figure 2) had a total of 28 species and a total species cover of 68%. The highest percent cover was by large gallberry (14%), followed by gallberry and dwarf live oak. No herbaceous species had a cover value greater than 1%. Transect 2 (Table 3, Figure 3) had a total of 16 species and a total species cover of 38%. The highest percent cover was by large gallberry (13%) followed by black titi, with lesser amounts of rusty staggerbush and purple bluestem.

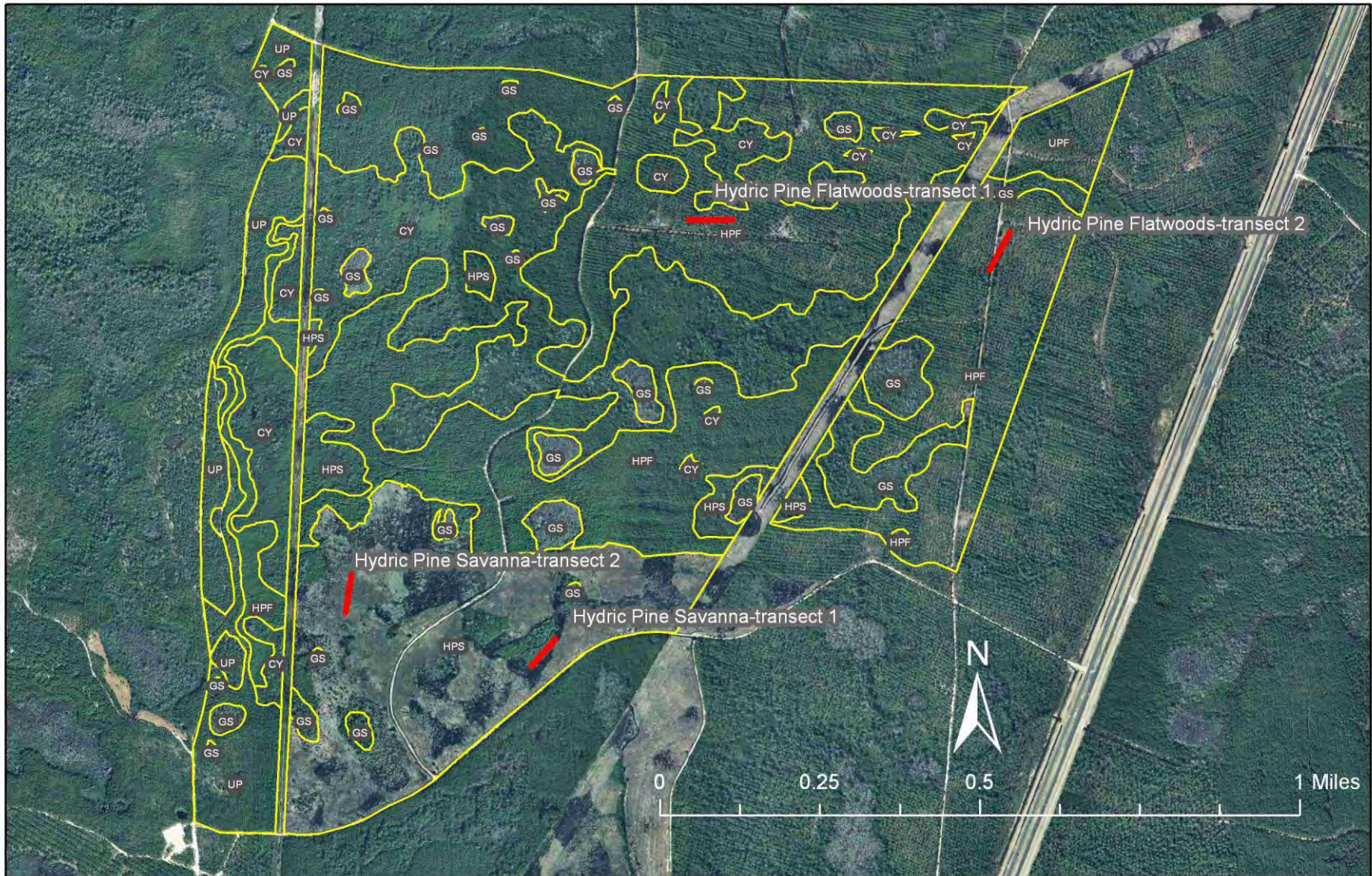


Figure 1. Location of permanent transects at Ward Creek West Mitigation Site. CY=Cypress, UP=Upland Pine, HPF=Hydric Pine Flatwoods, HPS=Hydric Pine Savanna, GS=Gum Swamp.

Table 1. Species observed in target communities at Ward Creek West Mitigation Site, November 13-14, 2012.

Scientific Name	Common Name	Cypress	Hydric Pine Flatwoods	Hydric Pine Savanna
<i>Acer rubrum</i>	red maple	X		
<i>Amphicarpum muhlenbergianum</i>	blue maidencane		X	
<i>Andropogon glomeratus</i>	bushy bluestem		X	X
<i>Andropogon glomeratus</i> var. <i>glaucopsis</i>	purple bluestem		X	X
<i>Andropogon virginicus</i>	broomsedge bluestem			X
<i>Aristida spiciformis</i>	bottlebrush threeawn		X	X
<i>Aristida stricta</i> var. <i>beyrichiana</i>	wiregrass		X	X
<i>Carex striata</i>	Walter's sedge			X
<i>Carphephorus odoratissimus</i>	vanillaleaf		X	
<i>Centella asiatica</i>	spadeleaf			X
<i>Chrysopsis lanuginosa</i>	Lynn Haven goldenaster			X
<i>Clethra alnifolia</i>	sweet pepperbush	X	X	
<i>Cliftonia monophylla</i>	black titi	X	X	X
<i>Cyperus retrorsus</i>	pinebarren flatsedge		X	
<i>Cyrilla racemiflora</i>	titi	X	X	X
<i>Dichanthelium commutatum</i>	variable witchgrass		X	
<i>Dichanthelium ensifolium</i>	cypress witchgrass		X	
<i>Dichanthelium scabriusculum</i>	woolly witchgrass		X	X
<i>Dichanthelium</i> sp.	witchgrass			X
<i>Dichanthelium sphaerocarpon</i>	roundseed witchgrass		X	
<i>Drosera capillaris</i>	pink sundew		X	X
<i>Drosera tracyi</i>	dewthreads			X
<i>Eriocaulon decangulare</i>	tenangle pipewort			X
<i>Eupatorium capillifolium</i>	dogfennel		X	
<i>Eupatorium mohrii</i>	Mohr's thoroughwort		X	
<i>Euthamia caroliniana</i>	slender flattop goldenrod		X	
<i>Gaylussacia dumosa</i>	dwarf huckleberry		X	
<i>Gaylussacia frondosa</i> var. <i>tomentosa</i>	blue huckleberry		X	
<i>Gaylussacia mosieri</i>	woolly huckleberry	X	X	
<i>Gelsemium sempervirens</i>	yellow jessamine		X	
<i>Helianthus angustifolius</i>	narrowleaf sunflower			X
<i>Helianthus radula</i>	stiff sunflower			X
<i>Hypericum brachyphyllum</i>	coastalplain St. John's wort		X	X
<i>Hypericum fasciculatum</i>	peelbark St. John's wort			X
<i>Hypericum hypericoides</i>	St. Andrew's cross		X	
<i>Hypericum microsepalum</i>	flatwoods St. John's wort		X	X
<i>Hypericum tetrapetalum</i>	fourpetal St. John's wort		X	X
<i>Ilex cassine</i> var. <i>myrtifolia</i>	myrtle-leaved holly	X	X	X
<i>Ilex coriacea</i>	large gallberry	X	X	X
<i>Ilex glabra</i>	gallberry		X	X
<i>Juncus marginatus</i>	grassleaf rush		X	
<i>Juncus scirpoides</i>	needlepod rush			X
<i>Kalmia hirsuta</i>	hairy wicky		X	X
<i>Lachnanthes caroliniana</i>	Carolina redroot			X

Scientific Name	Common Name	Cypress	Hydric Pine Flatwoods	Hydric Pine Savanna
<i>Lechea pulchella</i>	Leggett's pinweed			X
<i>Liatris chapmanii</i>	Chapman's gayfeather			X
<i>Liatris spicata</i>	dense gayfeather		X	X
<i>Lophiola aurea</i>	golden crest		X	X
<i>Ludwigia maritima</i>	seaside primrosewillow		X	
<i>Lycopodiella alopecuroides</i>	foxtail club-moss		X	X
<i>Lycopodiella appressa</i>	southern club-moss			X
<i>Lyonia ferruginea</i>	rusty staggerbush		X	
<i>Lyonia fruticosa</i>	coastalplain staggerbush			X
<i>Lyonia lucida</i>	fetterbush	X	X	X
<i>Magnolia virginiana</i>	sweetbay	X	X	X
<i>Myrica caroliniensis</i>	evergreen bayberry	X	X	
<i>Myrica cerifera</i>	wax myrtle	X	X	
<i>Nyssa ogeche</i>	ogeechee tupelo	X		
<i>Nyssa sylvatica</i> var. <i>biflora</i>	swamp tupelo	X	X	
<i>Nyssa ursina</i>	bog tupelo			X
<i>Oldenlandia corymbosa</i>	flattop mille grains		X	
<i>Oldenlandia uniflora</i>	clustered mille grains			X
<i>Osmunda cinnamomea</i>	cinnamon fern		X	
<i>Panicum anceps</i>	beaked panicum		X	
<i>Panicum verrucosum</i>	warty panicgrass		X	X
<i>Persea palustris</i>	swamp bay	X	X	X
<i>Photinia pyrifolia</i>	red chokeberry		X	
<i>Pinus elliotii</i>	slash pine	X	X	X
<i>Pinus serotina</i>	pond pine		X	
<i>Pinus</i> sp.	pine			X
<i>Pteridium aquilinum</i>	bracken fern		X	
<i>Quercus hemisphaerica</i>	laurel oak		X	
<i>Quercus minima</i>	dwarf live oak		X	
<i>Quercus myrtifolia</i>	myrtle oak		X	
<i>Quercus pumila</i>	runner oak		X	
<i>Rhexia virginica</i>	handsome harry		X	X
<i>Rhododendron canescens</i>	mountain azalea		X	
<i>Rhus copallinum</i>	winged sumac		X	
<i>Rhynchospora baldwinii</i>	Baldwin's beaksedge		X	
<i>Rhynchospora cephalantha</i>	bunched beaksedge		X	X
<i>Rhynchospora chalarocephala</i>	loosehead beaksedge			X
<i>Rhynchospora chapmanii</i>	Chapman's beaksedge		X	X
<i>Rhynchospora ciliaris</i>	fringed beaksedge		X	X
<i>Rhynchospora debilis</i>	savannah beaksedge		X	
<i>Rhynchospora fascicularis</i>	fascicled beaksedge		X	X
<i>Rhynchospora fernaldii</i>	Fernald's beaksedge		X	X
<i>Rhynchospora gracilentia</i>	slender beaksedge			X
<i>Rhynchospora microcephala</i>	bunched beaksedge		X	
<i>Rhynchospora plumosa</i>	plumed beaksedge		X	X
<i>Rhynchospora</i> sp.	beaksedge			X

Scientific Name	Common Name	Cypress	Hydric Pine Flatwoods	Hydric Pine Savanna
<i>Sabatia brevifolia</i>	shortleaf rosegentian		X	X
<i>Sarracenia flava</i>	yellow pitcherplant			X
<i>Sarracenia psittacina</i>	parrot pitcherplant			X
<i>Scleria reticularis</i>	netted nutrush		X	
<i>Serenoa repens</i>	saw palmetto		X	X
<i>Smilax auriculata</i>	earleaf greenbrier		X	
<i>Smilax glauca</i>	cat greenbrier		X	
<i>Smilax laurifolia</i>	laurel greenbrier		X	X
<i>Sphagnum</i> sp.	sphagnum moss	X		X
<i>Syngonanthus flavidulus</i>	yellow hatpins			X
<i>Taxodium ascendens</i>	pond cypress	X		X
unknown graminoid		X		
<i>Utricularia juncea</i>	southern bladderwort			X
<i>Utricularia subulata</i>	zigzag bladderwort			X
<i>Vaccinium corymbosum</i>	highbush blueberry		X	
<i>Vaccinium darrowii</i>	Darrow's blueberry		X	
<i>Vaccinium stamineum</i>	deerberry			X
<i>Vitis rotundifolia</i>	muscadine	X	X	
<i>Xyris ambigua</i>	coastalplain yellow-eyed grass		X	X
<i>Xyris caroliniana</i>	Carolina yellow-eyed grass		X	
<i>Xyris</i> cf. <i>jupicai</i>	Richard's yellow-eyed grass			X
<i>Xyris elliotii</i>	Elliott's yellow-eyed grass			X
<i>Xyris fimbriata</i>	fringed yellow-eyed grass			X
<i>Xyris flabelliformis</i>	savannah yellow-eyed grass			X
<i>Xyris platylepis</i>	tall yellow-eyed grass		X	
<i>Xyris</i> sp.	yellow-eyed grass	X		
Grand Total=116		20	78	69

Figure 2. Percent species cover in Hydric Pine Flatwoods Transect 1.

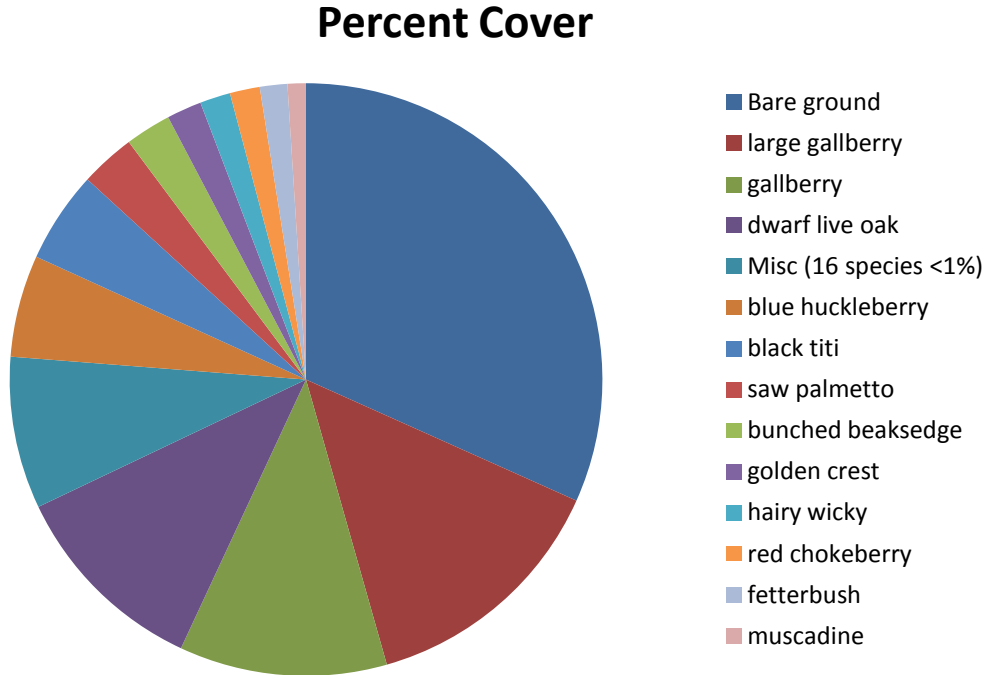


Table 2. Percent species cover in Hydric Pine Flatwoods Transect 1 (sampled on 11/13/12).

Scientific name	Common name	Average percent cover per quadrat
<i>Andropogon glomeratus</i>	bushy bluestem	0.73
<i>Andropogon glomeratus</i> var. <i>glaucopsis</i>	purple bluestem	0.47
<i>Aristida spiciformis</i>	bottlebrush threeawn	0.83
<i>Cliftonia monophylla</i>	black titi	5.00
<i>Cyrilla racemiflora</i>	titi	0.50
<i>Dichanthelium sphaerocarpon</i>	roundseed witchgrass	0.87
<i>Gaylussacia frondosa</i> var. <i>tomentosa</i>	blue huckleberry	5.57
<i>Gaylussacia mosieri</i>	woolly huckleberry	0.73
<i>Hypericum brachyphyllum</i>	coastalplain St. John's wort	0.23
<i>Hypericum hypericoides</i>	St. Andrew's cross	0.97
<i>Ilex coriacea</i>	large gallberry	13.90
<i>Ilex glabra</i>	gallberry	11.33
<i>Kalmia hirsuta</i>	hairy wicky	1.67
<i>Lophiola aurea</i>	golden crest	1.90
<i>Lyonia lucida</i>	fetterbush	1.50
<i>Photinia pyrifolia</i>	red chokeberry	1.63
<i>Quercus minima</i>	dwarf live oak	11.00
<i>Rhynchospora chapmanii</i>	Chapman's beaksedge	0.50

Scientific name	Common name	Average percent cover per quadrat
<i>Rhynchospora debilis</i>	savannah beaksedge	0.23
<i>Rhynchospora microcephala</i>	bunched beaksedge	2.50
<i>Rhynchospora plumosa</i>	plumed beaksedge	0.23
<i>Scleria reticularis</i>	netted nutrush	0.60
<i>Serenoa repens</i>	saw palmetto	3.00
<i>Smilax auriculata</i>	earleaf greenbrier	0.47
<i>Vaccinium darrowii</i>	Darrow's blueberry	0.47
<i>Vitis rotundifolia</i>	muscadine	1.00
<i>Xyris ambigua</i>	coastalplain yellow-eyed grass	0.23
<i>Xyris platylepis</i>	tall yellow-eyed grass	0.23
	Bare ground	31.70

Figure 3. Percent species cover in Hydric Pine Flatwoods Transect 2.

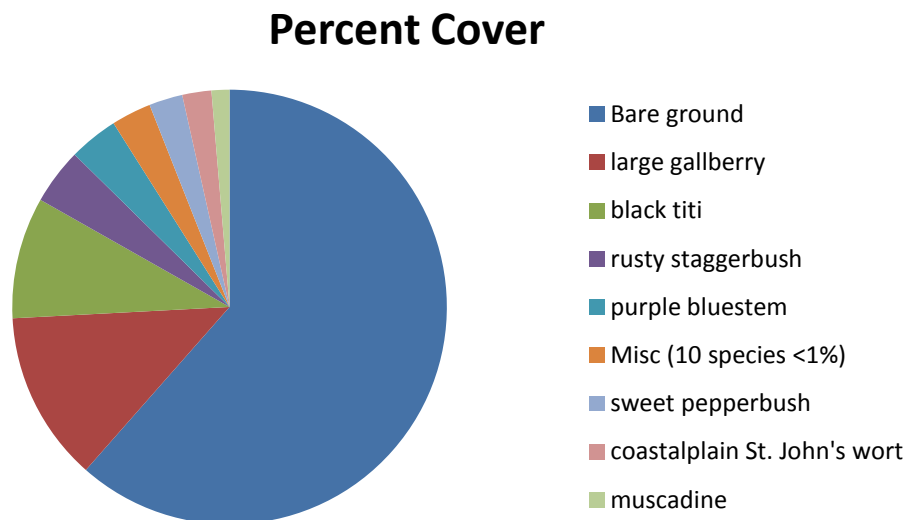


Table 3. Percent species cover in Hydric Pine Flatwoods Transect 2 (sampled on 11/14/12).

Scientific name	Common name	Average percent cover per quadrat
<i>Andropogon glomeratus</i> var. <i>glaucopsis</i>	purple bluestem	3.67
<i>Clethra alnifolia</i>	sweet pepperbush	2.50
<i>Cliftonia monophylla</i>	black titi	9.03
<i>Dichantherium commutatum</i>	variable witchgrass	0.47
<i>Hypericum brachyphyllum</i>	coastalplain St. John's wort	2.17
<i>Hypericum hypericoides</i>	St. Andrew's cross	0.23
<i>Ilex coriacea</i>	large gallberry	12.67
<i>Lophiola aurea</i>	golden crest	0.23

Scientific name	Common name	Average percent cover per quadrat
<i>Lyonia ferruginea</i>	rusty staggerbush	4.17
<i>Panicum anceps</i>	beaked panicum	0.10
<i>Pinus elliotii</i>	slash pine	0.03
<i>Rhynchospora fascicularis</i>	fascicled beaksedge	0.73
<i>Scleria reticularis</i>	netted nutrush	0.23
<i>Smilax laurifolia</i>	laurel greenbrier	0.70
<i>Vaccinium darrowii</i>	Darrow's blueberry	0.23
<i>Vitis rotundifolia</i>	muscadine	1.33
	Bare ground	61.50

Hydric Pine Savanna

Qualitative sampling. At time of sampling, the area with the target community of hydric pine savanna was dry with some saturated soil and standing water in dips. Vegetative cover consisted primarily of a dense, tall stand of broomsedge bluestem with widely scattered young slash pines and pond cypress and beaksedges in the dips. Wiregrass was patchy in areas where broomsedge bluestem was less dense. Clumps of shrubs (fetterbush, titi and black titi) occurred throughout. The total number of species observed in this community was 68 (Table 1).

Quantitative sampling. Transect 1 (Table 4, Figure 4) had a total of 21 species and a total species cover of 59%. The highest percent cover was by purple bluestem (34%), followed by peelbark St. John's wort and black titi. Wiregrass made up 1% cover. Transect 2 (Table 5, Figure 5) had a total of 24 species and a total species cover of 59%. The highest percent cover was by purple bluestem (19%) followed by black titi, wiregrass, and titi. Plumed beaksedge, a good indicator of hydric pine savanna, occurred at low values in this transect.

Figure 4. Percent species cover in Hydric Pine Savanna Transect 1.

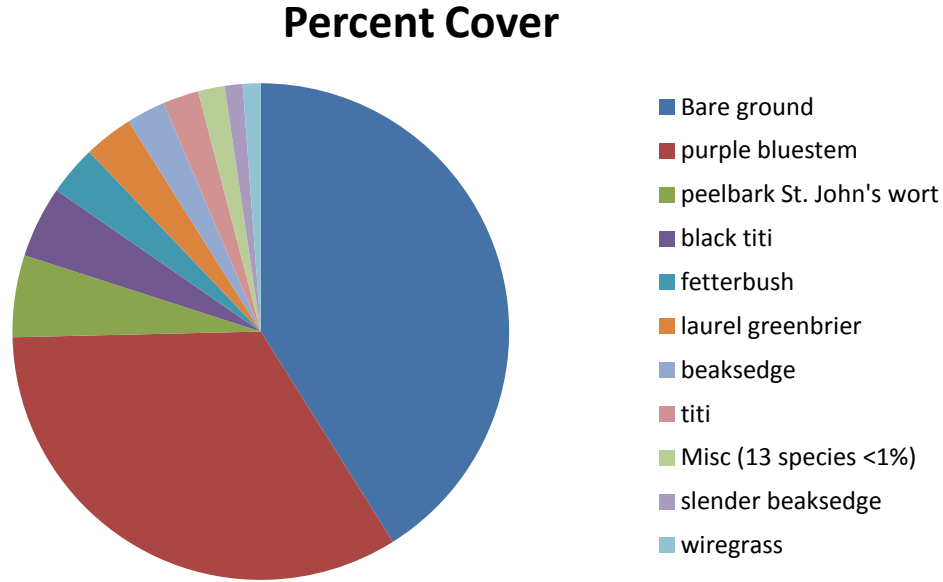


Table 4. Percent species cover in Hydric Pine Savanna Transect 1 (sampled on 11/13/12).

Scientific name	Common name	Average percent cover per quadrat
<i>Andropogon glomeratus</i> var. <i>glaucopsis</i>	purple bluestem	33.57
<i>Aristida stricta</i> var. <i>beyrichiana</i>	wiregrass	1.17
<i>Cliftonia monophylla</i>	black titi	4.67
<i>Cyrilla racemiflora</i>	titi	2.33
<i>Drosera capillaris</i>	pink sundew	0.23
<i>Eriocaulon decangulare</i>	tenangle pipewort	0.03
<i>Hypericum fasciculatum</i>	peelbark St. John's wort	5.33
<i>Ilex coriacea</i>	large gallberry	0.10
<i>Lachnanthes caroliana</i>	Carolina redroot	0.13
<i>Lophiola aurea</i>	golden crest	0.03
<i>Lyonia lucida</i>	fetterbush	3.23
<i>Panicum verrucosum</i>	warty panicgrass	0.03
<i>Pinus</i> sp. - seedling	pine seedling	0.03
<i>Rhynchospora cephalantha</i>	bunched beaksedge	0.27
<i>Rhynchospora chalarocephala</i>	loosehead beaksedge	0.03
<i>Rhynchospora chapmanii</i>	Chapman's beaksedge	0.10
<i>Rhynchospora gracilentia</i>	slender beaksedge	1.17
<i>Rhynchospora</i> sp.	beaksedge	2.53
<i>Sarracenia flava</i>	yellow pitcherplant	0.23
<i>Smilax laurifolia</i>	laurel greenbrier	3.20
<i>Xyris elliotii</i>	Elliott's yellow-eyed grass	0.47
	Bare ground	41.07

Figure 5. Percent species cover in Hydric Pine Savanna Transect 2.

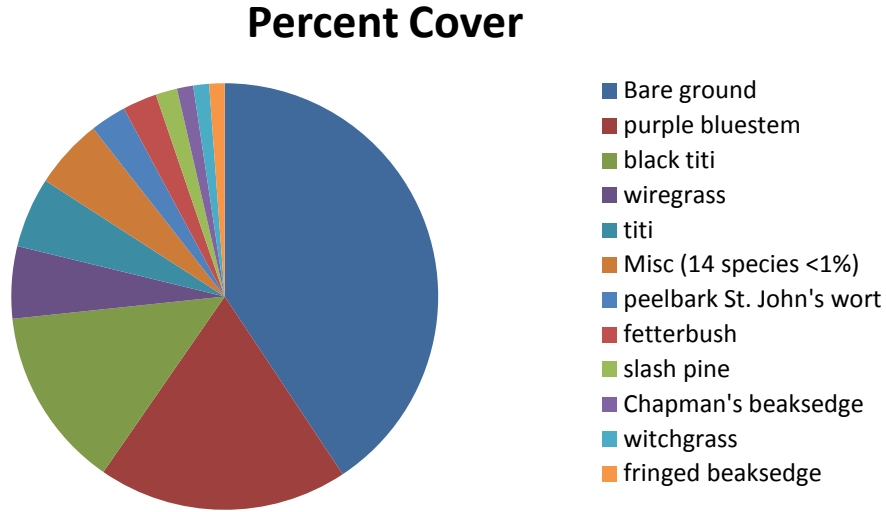


Table 5. Percent species cover in Hydric Pine Savanna Transect 2 (sampled on 11/14/12).

Scientific name	Common name	Average percent cover per quadrat
<i>Andropogon glomeratus</i> var. <i>glaucopsis</i>	purple bluestem	18.97
<i>Andropogon virginicus</i>	broomsedge bluestem	0.23
<i>Aristida stricta</i> var. <i>beyrichiana</i>	wiregrass	5.47
<i>Cliftonia monophylla</i>	black titi	13.70
<i>Cyrilla racemiflora</i>	titi	5.33
<i>Dichanthelium</i> sp.	witchgrass	1.20
<i>Helianthus angustifolius</i>	narrowleaf sunflower	0.30
<i>Hypericum fasciculatum</i>	peelbark St. John's wort	2.73
<i>Hypericum tbrachyphyllum</i>	Coastalplain St. John's wort	0.50
<i>Ilex glabra</i>	gallberry	0.50
<i>Lyonia fruticosa</i>	coastalplain staggerbush	0.50
<i>Lyonia lucida</i>	fetterbush	2.60
<i>Oldenlandia uniflora</i>	clustered mille grains	0.03
<i>Pinus elliotii</i>	slash pine	1.63
<i>Pinus</i> sp. - seedling	pine seedling	0.07
<i>Rhynchospora cephalantha</i>	bunched beaksedge	0.23
<i>Rhynchospora chapmanii</i>	Chapman's beaksedge	1.23
<i>Rhynchospora ciliaris</i>	fringed beaksedge	1.17
<i>Rhynchospora fascicularis</i>	fascicled beaksedge	0.97
<i>Rhynchospora plumosa</i>	plumed beaksedge	0.73
<i>Smilax laurifolia</i>	laurel greenbrier	0.33
<i>Xyris ambigua</i>	coastalplain yellow-eyed grass	0.60
<i>Xyris</i> cf. <i>jupicai</i>	Richard's yellow-eyed grass	0.03
<i>Xyris flabelliformis</i>	savannah yellow-eyed grass	0.27
	Bare ground	40.67

Cypress

Qualitative sampling. At time of sampling, the muck soils of the area with the target community of cypress were wet with some standing water in lower areas. The vegetative cover consisted of a dense evergreen canopy about 25 ft tall composed of titi, swamp bay slash pine and sweetbay with scattered ogeechee tupelo, blackgum, and pond cypress. In many places titi, black titi and fetterbush formed an impenetrable shrub layer in the understory. Total number of species observed in this community was 20 (Table 1).

A total of 116 native species were observed during the November 13-14, 2012 monitoring period over all the target communities at Ward Creek West. Thirty-eight of these had not been previously recorded at this site during the 2010 monitoring period.