Vegetation Monitoring at Four Northwest Florida Water Management District Mitigation Sites Fall 2015

Ann F. Johnson
Gary E. Schultz
Frank Price

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Florida Natural Area Inventory
1018 Thomasville Road, Suite 200-C
Tallahassee, FL 32303
Gary R. Knight, Director

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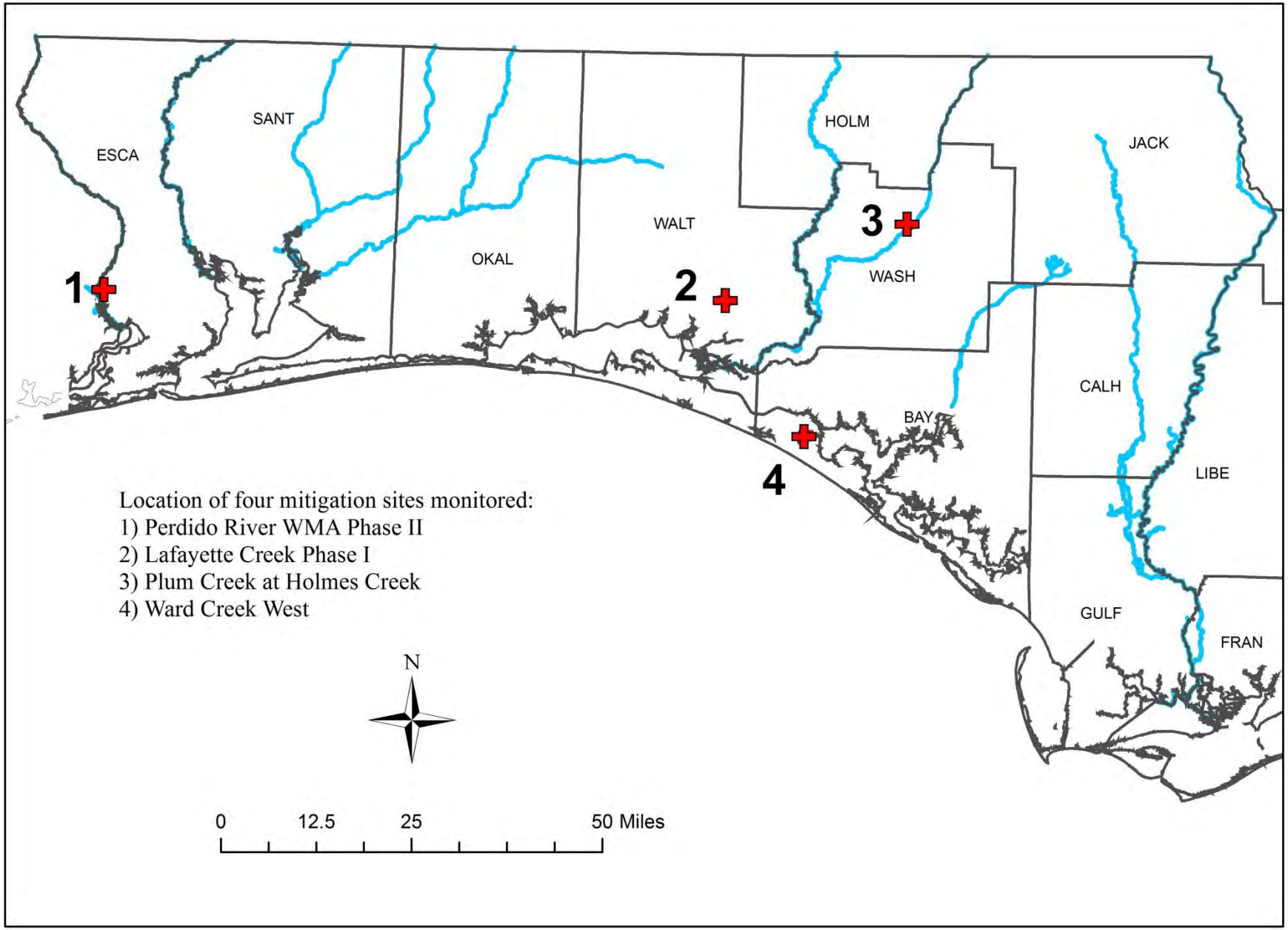
This document contains separate qualitative and quantitative vegetation monitoring reports for four mitigation sites managed by the Northwest Florida Water Management District:

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.


ESCA
SANT
OKAL
WALT
HOLM
WASH
JACK
CALH
BAY
LIBE
GULF
FRAN
1
2
3
4
Location of four mitigation sites monitored:
1) Perdido River WMA Phase II
2) Lafayette Creek Phase I
3) Plum Creek at Holmes Creek
4) Ward Creek West
N
0
12.5
25
50 Miles

Perdido River Water Management Area – Phase II Mitigation Site

Qualitative and Quantitative Monitoring

December 2015

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

The Perdido River Water Management Area Phase II mitigation project compensates for the loss of wetland function of bottomland hardwood forest resulting from the 2007 replacement of the US 90 Perdido River Bridge in Escambia County, Florida. The mitigation area of 67 acres in the Perdido River WMA is located along the south side of US 90 (Nine Mile Road) and 6.4 miles west of Interstate Highway10 (Figure PR-1). The mitigation project aims to restore areas of mixed forested wetlands (MFW), hydric savanna (HS), hydric pine flatwoods (HPF) and pine flatwoods (PF) which were converted to loblolly pine plantation in 2002 (Figure PR-1). Quantitative and qualitative monitoring was used to document the current plant species composition and vegetation structure of these targeted communities. The site vegetation was previously monitored by FNAI biologists in the fall of 2012, 2013, and 2014.

METHODS

The quantitative monitoring utilized 150-foot long permanent transect lines previously marked at each end with metal t-posts during the 2012 survey. Two transects were in each targeted natural community type: hydric savanna, mixed forested wetland, and hydric pine flatwoods (Figure PR-2). Data recorded consisted of the visually estimated percent cover of each plant species in eight separate meter square quadrats. Tree trunks in quadrats were noted in comments but not recorded as cover; canopy over 2 m in height was also not recorded as cover in quadrats. The quadrats were located at 0, 20, 40, 60, 80, 100, 120, and 140 feet along the left side of the transect line as one stands at the 0-ft quadrat and faces toward the 140-ft quadrat. The qualitative monitoring consisted of recording the species and vegetation structure observed along meandering pedestrian transects through each of the three target communities plus the pine flatwoods area. The field surveys were performed by FNAI botanist Gary Schultz on November 9 and 10, 2015.

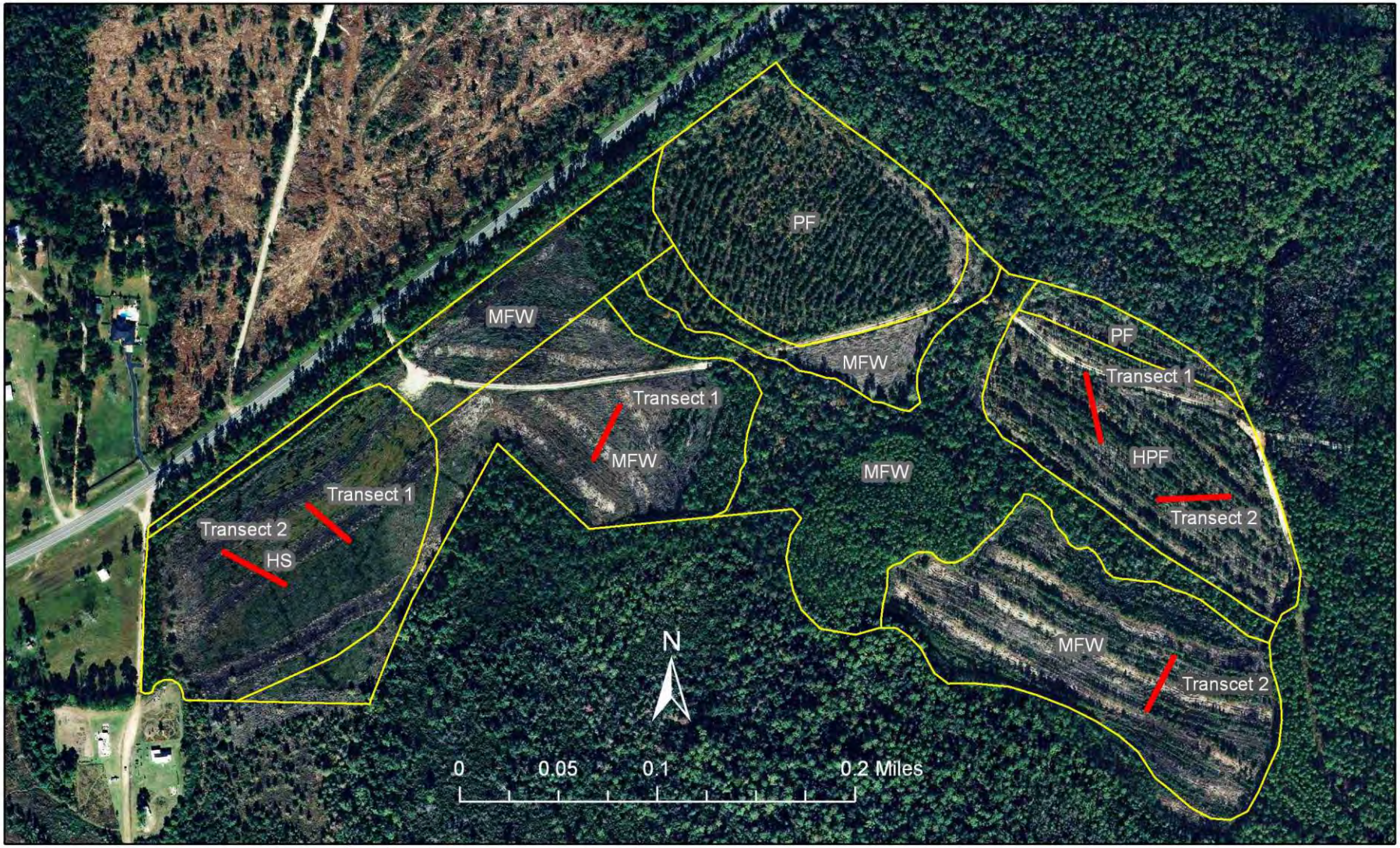

Figure PR-1. Location of permanent transects at Perdido Phase II Mitigation Site. HS=Hydric Savanna, HPF=Hydric Pine Flatwoods, MFW=Mixed Forested Wetlands, PF=Pine Flatwoods.

RESULTS AND DISCUSSION

A total of 109 plant species were observed during the 2015 monitoring of the target communities at Perdido Phase II (Table PR-1).

Hydric Savanna

Qualitative sampling. The disturbed hydric savanna restoration area was dominated by sphagnum moss, purple bluestem, pinebarren goldenrod, and viviparous spikerush. Shrubs were primarily coastalplain St. John's wort, sawtooth blackberry, and swamp bay growing along the slightly elevated windrows formed when the land was cleared for silviculture. Occasional slash pine and red maple saplings were widely scattered. The ground was generally shallowly inumdated. Table PR-1 provides a comprehensive list of the 49 plant species identified in this community.

Quantitative sampling. Transect 1 (Table PR-2, Figure PR-2) had a total of 23 species. Their total cover made up more than 100% of the area since sphagnum moss underlay the other species. In order to represent relative species cover in Figure PR-2 below, percent of total vegetative cover was used rather than percent cover of area. Table PR-2 gives the percent cover of area. The dominant species were sphagnum moss, pine barren goldenrod, handsome harry, purple bluestem, smallfruit beggarticks, and viviparous spikerush. Transect 2 (Table PR-3, Figure PR-3) had a total of 23 species which also covered more than 100% of the area. The dominant species were the same, plus Virginia chain fern and Carolina redroot.

Table PR-1. Species observed in target communities at Perdido River WMA – Phase II Mitigation Site on November 9 and 10, 2015.

Scientific Name	Common Name	hydric pine flatwoods	hydric savanna	pine flatwoods	mixed forested wetland	Grand Total
Acer rubrum	red maple	X	X	X	X	4
Andropogon glomeratus	bushy bluestem		X	X		2
Andropogon glomeratus var. *glaucopsis*	purple bluestem	X	X	X	X	4
Andropogon virginicus	broomsedge bluestem	X	X	X	X	4
Anthaenantia villosa	green silkyscale	X				1
Aristida stricta var. *beyrichiana*	wiregrass	X		X		2
Arundinaria gigantea	switchcane	X			X	2
Baccharis halimifolia	groundsel tree	X				1
Bidens mitis	smallfruit beggarticks	X	X		X	3
Calamovilfa curtissii	Curtiss' sandgrass	X				1
Carex glaucescens	clustered sedge	X	X	X		3
Carex sp.	sedge	X				1
Castanea pumila	chinquapin			X		1

Scientific Name	Common Name	hydric pine flatwoods	hydric savanna	pine flatwoods	mixed forested wetland	Grand Total
Centella asiatica	spadeleaf		X	X	X	3
Chamaecyparis thyoides	Atlantic white cedar		X		X	2
Circium nuttallii	Nuttall's thistle				X	1
Cinnamomum camphora	camphor tree			X		1
Clethra alnifolia	sweet pepperbush	X				1
Cliftonia monophylla	black titi		X		X	2
Cyrilla racemiflora	titi	X	X		X	3
Dichanthelium scabriusculum	woolly witchgrass	X			X	2
Dichanthelium sp.	witchgrass	X		X	X	3
Drosera brevifolia	dwarf sundew				X	1
Drosera capillaris	pink sundew				X	1
Eleocharis vivipara	viviparous spikerush		X			1
Elephantopus carolinianus	Carolina elephantsfoot	X		X		2
Eragrostis elliottii	Elliott's lovegrass				X	1
Eupatorium capillifolium	dogfennel	X		X	X	3
Eupatorium mohrii	Mohr's thoroughwort	X	X	X	X	4
Eupatorium rotundifolium	roundleaf thoroughwort	X			X	2
Euthamia caroliniana	slender flattop goldenrod	X	X	X	X	4
Fuirena breviseta	saltmarsh umbrellasedge		X			1
Gaylussacia mosieri	woolly huckleberry	X			X	2
Helianthus angustifolius	narrowleaf sunflower	X			X	2
Hypericum brachyphyllum	coastalplain St. John's wort		X		X	2
Hypericum cistifolium	roundpod St. John's wort	X		X	X	3
Hypericum crux-andreae	St. Peter's Wort	X			X	2
Hypericum hypericoides	St. Andrew's cross	X		X		2
Hypericum tetrapetalum	fourpetal St. John's wort	X				1
Ilex cassine	dahoon	X		X		2
Ilex cassine var. *myrtifolia*	myrtle-leaved holly		X			1
Ilex coriacea	large gallberry	X		X	X	3
Ilex glabra	gallberry	X	X	X	X	4
Ilex opaca	American holly	X				1
Ilex vomitoria	yaupon	X		X	X	3
Juncus dichotomus	forked rush		X			1
Juniperus virginiana	red cedar		X		X	2
Lachnanthes caroliana	Carolina redroot	X	X	X	X	4
Lachnocaulon anceps	whitehead bogbutton	X		X	X	3
Lobelia sp.	lobelia			X		1

Scientific Name	Common Name	hydric pine flatwoods	hydric savanna	pine flatwoods	mixed forested wetland	Grand Total
Ludwigia maritima	seaside primrosewillow	X				1
Ludwigia sp.	primrosewillow	X				1
Ludwigia suffruticosa	shrubby primrosewillow		X			1
Lycopodiella alopecuroides	foxtail club-moss	X	X	X	X	4
Lycopus rubellus	taperleaf waterhorehound	X	X			2
Lyonia lucida	fetterbush	X			X	2
Magnolia virginiana	sweetbay		X	X	X	3
Myrica cerifera	wax myrtle	X	X	X	X	4
Oldenlandia uniflora	clustered mille graines	X	X		X	3
Osmunda cinnamomea	cinnamon fern	X	X	X	X	4
Osmunda regalis var. *spectabilis*	royal fern	X		X		2
Panicum anceps	beaked panicum	X		X		2
Panicum hemitomon	maidencane				X	1
Panicum verrucosum	warty panicgrass	X	X		X	3
Panicum virgatum	switchgrass	X				1
Persea palustris	swamp bay	X	X	X	X	4
Photinia pyrifolia	red chokeberry	X	X			2
Pinus elliottii	slash pine	X	X		X	3
Pinus glabra	spruce pine				X	1
Pinus palustris	longleaf pine				X	1
Pinus taeda	loblolly pine	X	X	X	X	4
Pluchea longifolia	longleaf camphorweed	X		X		2
Polygala cymosa	tall pinebarren milkwort		X			1
Polygala lutea	orange milkwort				X	1
Polytrichum commune	haircap moss				X	1
Pteridium aquilinum	bracken fern	X				1
Quercus nigra	water oak	X		X		2
Quercus virginiana	live oak			X		1
Rhexia virginica	handsome harry	X	X		X	3
Rhododendron canescens	mountain azalea	X				1
Rhus copallinum	winged sumac	X			X	2
Rhynchospora fascicularis	fascicled beaksedge	X	X		X	3
Rhynchospora sp.	beaksedge		X			1
Rubus pensilvanicus	sawtooth blackberry	X	X	X	X	4
Saccharum giganteum	sugarcane plumegrass	X	X			2
Sapium sebiferum	Chinese tallow	X				1
Scleria sp.	nutrush	X				1

Scientific Name	Common Name	hydric pine flatwoods	hydric savanna	pine flatwoods	mixed forested wetland	Grand Total
Serenoa repens	saw palmetto				X	1
Smilax bona-nox	saw greenbrier			X		1
Smilax glauca	cat greenbrier	X		X	X	3
Smilax laurifolia	laurel greenbrier				X	1
Solidago fistulosa	pinebarren goldenrod	X	X	X	X	4
Sphagnum sp.	sphagnum moss	X	X	X	X	4
Symphyotrichum dumosum	rice button aster	X			X	2
Taxodium distichum	bald cypress		X		X	2
Toxicodendron radicans	eastern poison ivy	X	X		X	3
unknown moss	unknown moss	X	X			2
Vaccinium corymbosum	highbush blueberry	X	X	X		3
Vaccinium elliottii	Elliott's blueberry	X		X		2
Viola lanceolata	bog white violet	X			X	2
Viola primulifolia	primroseleaf violet				X	1
Viola sororia	common blue violet	X				1
Vitis rotundifolia	muscadine	X	X	X	X	4
Woodwardia areolata	netted chain fern	X	X	X	X	4
Woodwardia virginica	Virginia chain fern	X	X	X	X	4
Xyris ambigua	coastalplain yellow-eyed grass		X		X	2
Xyris elliottii	Elliott's yellow-eyed grass				X	1
Xyris fimbriata	fringed yellow-eyed grass		X			1
Xyris flabelliformis	savannah yellow-eyed grass				X	1
Total number of species: 109		73	49	44	66	232

Figure PR-2. Percent of total vegetative cover for plant species in Hydric Savanna Transect 1.

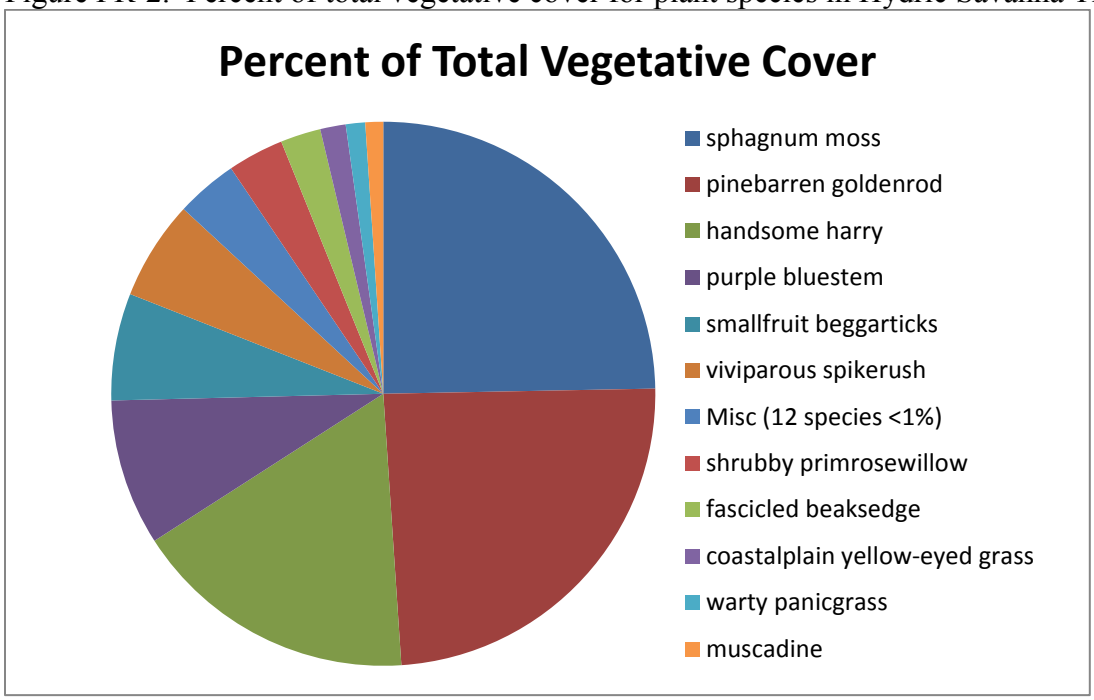

Table PR-2. Percent cover of plant species in Hydric Savanna Transect 1 when sampled on November 10, 2015.

Scientific name	Common name	Average percent cover per quadrat
Sphagnum sp.	sphagnum moss	50.94
Solidago fistulosa	pinebarren goldenrod	50.00
Rhexia virginica	handsome harry	35.00
Andropogon glomeratus var. *glaucopsis*	purple bluestem	17.94
Bidens mitis	smallfruit beggarticks	13.13
Eleocharis vivipara	viviparous spikerush	12.19
Ludwigia suffruticosa	shrubby primrosewillow	6.88
Rhynchospora fascicularis	fascicled beaksedge	4.94
Xyris ambigua	coastalplain yellow-eyed grass	3.13
Panicum verrucosum	warty panicgrass	2.38
Vitis rotundifolia	muscadine	2.19
Andropogon virginicus	broomsedge bluestem	0.94
Hypericum brachyphyllum	coastalplain St. John's wort	0.94
Lachnanthes caroliana	Carolina redroot	0.94
Persea palustris	swamp bay	0.94
Saccharum giganteum	sugarcane plumegrass	0.94
Woodwardia virginica	Virginia chain fern	0.94
Juncus dichotomus	forked rush	0.44
Photinia pyrifolia	red chokeberry	0.44

Scientific name	Common name	Average percent cover per quadrat
Toxicodendron radicans	eastern poison ivy	0.44
Eupatorium mohrii	Mohr's thoroughwort	0.38
Acer rubrum	red maple	0.19
Lycopus rubellus	taperleaf waterhorehound	0.06
	Bare ground	0.00

Figure PR-3. Percent of total vegetative cover for plant species in Hydric Savanna Transect 2.

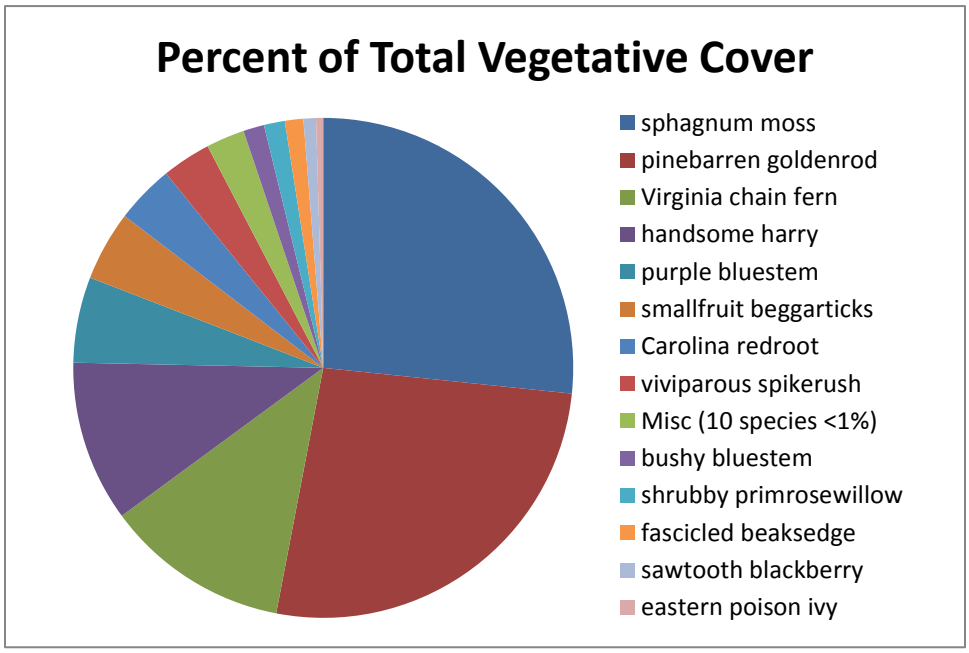

Table PR-3. Percent cover of plant species in Hydric Savanna Transect 2 when sampled on November 10, 2015.

Scientific name	Common name	Average percent cover per quadrat
Sphagnum sp.	sphagnum moss	61.56
Solidago fistulosa	pinebarren goldenrod	60.94
Woodwardia virginica	Virginia chain fern	27.50
Rhexia virginica	handsome harry	24.06
Andropogon glomeratus var. *glaucopsis*	purple bluestem	12.81
Bidens mitis	smallfruit beggarticks	10.44
Lachnanthes caroliana	Carolina redroot	8.75
Eleocharis vivipara	viviparous spikerush	7.31
Andropogon glomeratus	bushy bluestem	3.13
Ludwigia suffruticosa	shrubby primrosewillow	3.13
Rhynchospora fascicularis	fascicled beaksedge	2.75
Rubus pensilvanicus	sawtooth blackberry	1.88
Toxicodendron radicans	eastern poison ivy	1.06

Scientific name	Common name	Average percent cover per quadrat
Juncus dichotomus	forked rush	0.94
unknown graminoid	unknown graminoid	0.88
Woodwardia areolata	netted chain fern	0.88
Euthamia caroliniana	slender flattop goldenrod	0.63
Rhynchospora sp.	beaksedge	0.63
Acer rubrum	red maple	0.56
Panicum verrucosum	warty panicgrass	0.44
Saccharum giganteum	sugarcane plumegrass	0.44
Centella asiatica	spadeleaf	0.19
Oldenlandia uniflora	clustered mille graines	0.19
	Bare ground	0.00

Mixed Forested Wetland

Qualitative sampling. The target community of mixed forested wetland (Figure PR-1) had a total of 66 observed plant species (Table PR-1). The vegetative cover was dominated by the tall grasses, purple bluestem and broomsedge bluestem. Sphagnum moss, pinebarren goldenrod, beakrush, and witchgrass were common. The shrubs, black titi, fetterbush, and sawtooth blackberry were mainly on slightly elevated windrows from past silviculture activities. Sapling slash and spruce pines were widely scattered throughout.

Quantitative sampling. Transect 1 had a total of 36 species and no bare ground (Table PR-4, Figure PR-4). Purple bluestem and sphagnum moss formed the majority of the herbaceous cover, with woody species sharing dominance, including slash pine, spruce pine, sawtooth blackberry and black titi. Transect 2 (Table PR-5, Figure PR-5) had a total of 28 species with no bare ground. The highest percent cover was by purple bluestem, with smaller amounts of sphagnum moss. Woody species were sparse, including primarily sawtooth blackberry, loblolly pine saplings, and swamp bay.

Figure PR-4. Percent of total vegetative cover for species in Mixed Forested Wetland Transect 1.

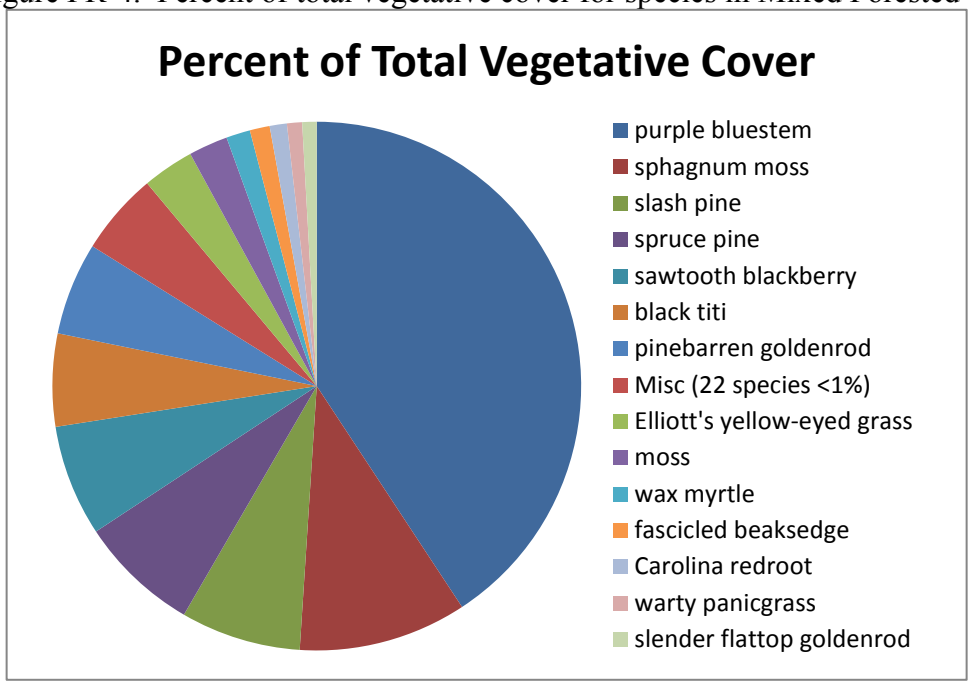

Table PR-4. Percent cover of plant species in Mixed Forested Wetland Transect 1 when sampled on November 9, 2015.

Scientific name	Common name	Average percent cover per quadrat
Andropogon glomeratus var. glaucopsis	purple bluestem	60.63
Sphagnum sp.	sphagnum moss	15.31
Pinus elliottii	slash pine	10.94
Pinus glabra	spruce pine	10.94
Rubus pensilvanicus	sawtooth blackberry	10.13
Cliftonia monophylla	black titi	8.44
Solidago fistulosa	pinebarren goldenrod	8.44
Xyris elliottii	Elliott's yellow-eyed grass	4.69
moss	moss	3.56
Myrica cerifera	wax myrtle	2.19
Rhynchospora fascicularis	fascicled beaksedge	1.81
Lachnanthes caroliana	Carolina redroot	1.56
Panicum verrucosum	warty panicgrass	1.38
Euthamia caroliniana	slender flattop goldenrod	1.31
Andropogon virginicus	broomsedge bluestem	0.94
Smilax glauca	cat greenbrier	0.88
Eupatorium rotundifolium	roundleaf thoroughwort	0.75
Oldenlandia uniflora	clustered mille graines	0.50
Bidens mitis	smallfruit beggarticks	0.44
Chamaecyparis thyoides	Atlantic white cedar	0.44

Scientific name	Common name	Average percent cover per quadrat
Dichanthelium sp.	witchgrass	0.44
Gaylussacia mosieri	woolly huckleberry	0.44
Ilex glabra	gallberry	0.44
Lycopodiella alopecuroides	foxtail club-moss	0.44
Toxicodendron radicans	eastern poison ivy	0.44
Viola lanceolata	bog white violet	0.19
Lachnocaulon anceps	whitehead bogbutton	0.13
Drosera brevifolia	dwarf sundew	0.06
Osmunda cinnamomea	cinnamon fern	0.06
Viola primulifolia	primroseleaf violet	0.06
Woodwardia virginica	Virginia chain fern	0.06
Xyris flabelliformis	savannah yellow-eyed grass	0.06
	Bare ground	0.00

Figure PR-5. Percent of total vegetative cover for plant species in Mixed Forested Wetland Transect 2.

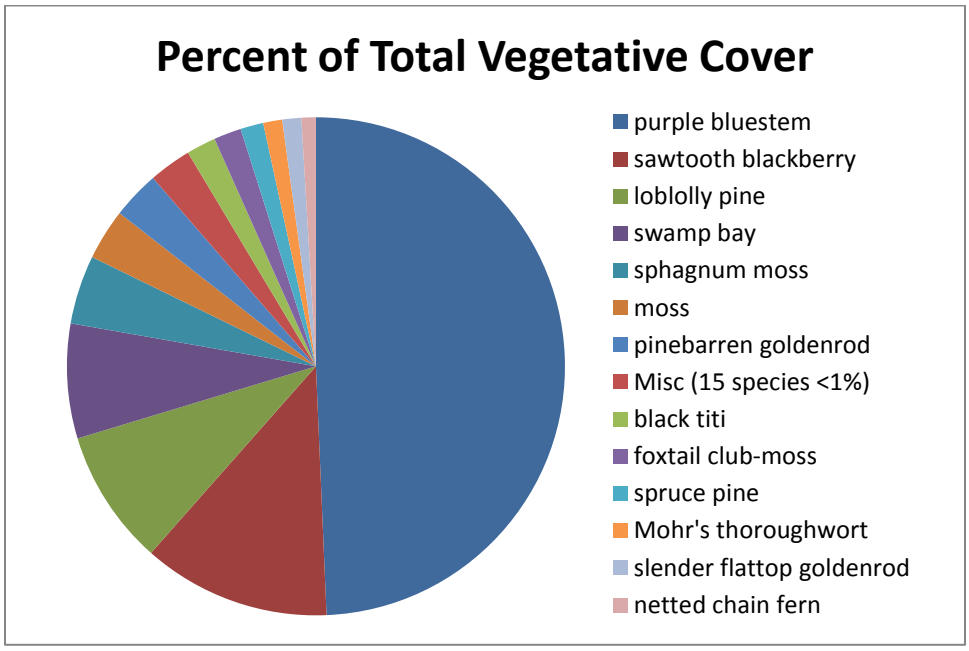

Table PR-5. Percent cover of plant species in Mixed Forested Wetland Transect 2 when sampled on November 9, 2015.

Scientific name	Common name	Average percent cover per quadrat
Andropogon glomeratus var. *glaucopsis*	purple bluestem	72.50
Rubus pensilvanicus	sawtooth blackberry	17.94
Pinus taeda	loblolly pine	12.94

Scientific name	Common name	Average percent cover per quadrat
Persea palustris	swamp bay	10.94
Sphagnum sp.	sphagnum moss	6.56
moss	moss	4.88
Solidago fistulosa	pinebarren goldenrod	4.56
Cliftonia monophylla	black titi	2.81
Lycopodiella alopecuroides	foxtail club-moss	2.63
Pinus glabra	spruce pine	2.19
Eupatorium mohrii	Mohr's thoroughwort	1.81
Euthamia caroliniana	slender flattop goldenrod	1.81
Woodwardia areolata	netted chain fern	1.38
Rhynchospora fascicularis	fascicled beaksedge	0.88
Oldenlandia uniflora	clustered mille graines	0.63
Smilax glauca	cat greenbrier	0.63
Viola primulifolia	primroseleaf violet	0.50
Ilex coriacea	large gallberry	0.38
Hypericum crux-andreae	St. Peter's wort	0.19
Magnolia virginiana	sweetbay	0.19
Vitis rotundifolia	muscadine	0.19
Acer rubrum	red maple	0.13
Drosera capillaris	pink sundew	0.06
Lachnocaulon anceps	whitehead bogbutton	0.06
Polygala lutea	orange milkwort	0.06
Smilax laurifolia	laurel greenbrier	0.06
Xyris ambigua	coastalplain yellow-eyed grass	0.06
Xyris sp.	yellow-eyed grass	0.06
	Bare ground	0.00

Hydric Pine Flatwoods

Qualitative monitoring. The target community of hydric pine flatwoods had a total of 73 plant species (Table PR-1). The nearly closed canopy of planted loblolly pines was about 30 ft tall. The open shrub layer consisted mainly of sawtooth blackberry, St. Andrew's cross, and swamp bay. The muscadine grape vine was common. The bedded ground frequently had patches bare of vegetation and covered by pine needle litter. The herbaceous layer was dominated by wiregrass, warty panicum, sphagnum, and broomsedge bluestem. Loblolly pine seedlings were common throughout. Several plants of Curtiss' sandgrass (*Calamovilfa curtissii*), state listed as threatened, were noted in this community.

Quantitative monitoring. Transect 1 had a total of 20 species with 69% bare ground (i.e., unvegetated ground; Figure PR-6, Table PR-6). Wiregrass, muscadine, and cinnamon fern were the most abundant herbs. Transect 2 (Figure PR-7, Table PR-7) had a total of 37 species with

33% bare ground. Common herbs were wiregrass, cinnamon fern, sphagnum moss, and netted chain fern.

Figure PR-6. Percent cover of plant species in Hydric Pine Flatwoods Transect 1.

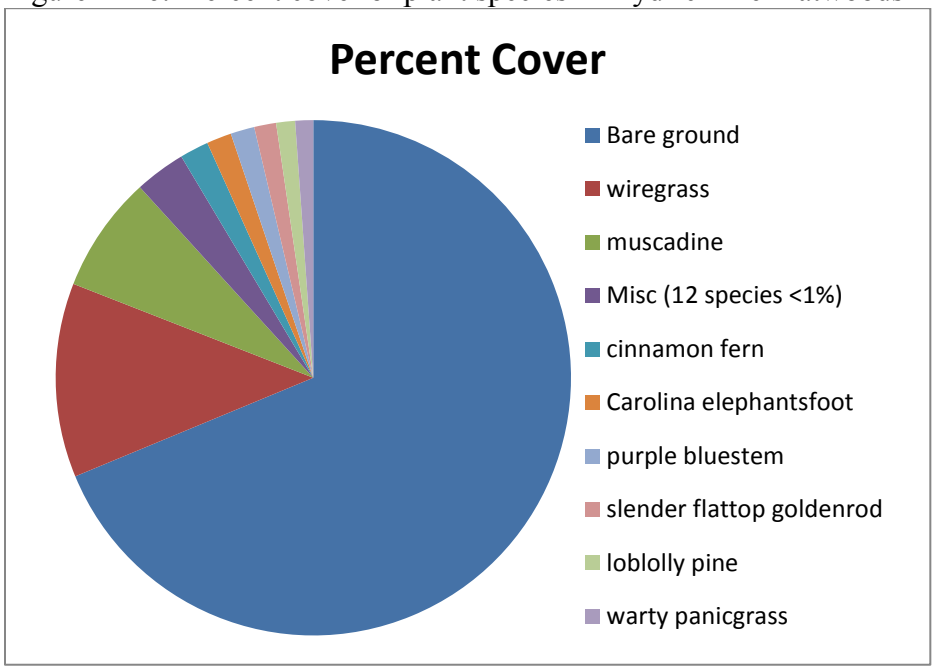

Table PR-6. Percent cover of species in Hydric Pine Flatwoods Transect 1 when sampled on November 9, 2015.

Scientific name	Common name	Average percent cover per quadrat
Aristida stricta var. *beyrichiana*	wiregrass	12.19
Vitis rotundifolia	muscadine	7.31
Osmunda cinnamomea	cinnamon fern	1.81
Elephantopus carolinianus	Carolina elephantsfoot	1.56
Andropogon glomeratus var. *glaucopsis*	purple bluestem	1.50
Euthamia caroliniana	slender flattop goldenrod	1.38
Pinus taeda	loblolly pine	1.19
Panicum verrucosum	warty panicgrass	1.13
Sphagnum sp.	sphagnum moss	0.63
Rubus pensilvanicus	sawtooth blackberry	0.44
Smilax glauca	cat greenbrier	0.44
Andropogon virginicus	broomsedge bluestem	0.38
Toxicodendron radicans	eastern poison ivy	0.38
Oldenlandia uniflora	clustered mille graines	0.31
Scleria sp.	nutrush	0.19
Solidago fistulosa	pinebarren goldenrod	0.19
Dichanthelium sp.	witchgrass	0.06

Scientific name	Common name	Average percent cover per quadrat
Galium sp.	bedstraw	0.06
Ludwigia sp.	primrosewillow	0.06
Viola sororia	common blue violet	0.06
	Bare ground	68.75

Figure PR-7. Percent cover of plant species in Hydric Pine Flatwoods Transect 2.

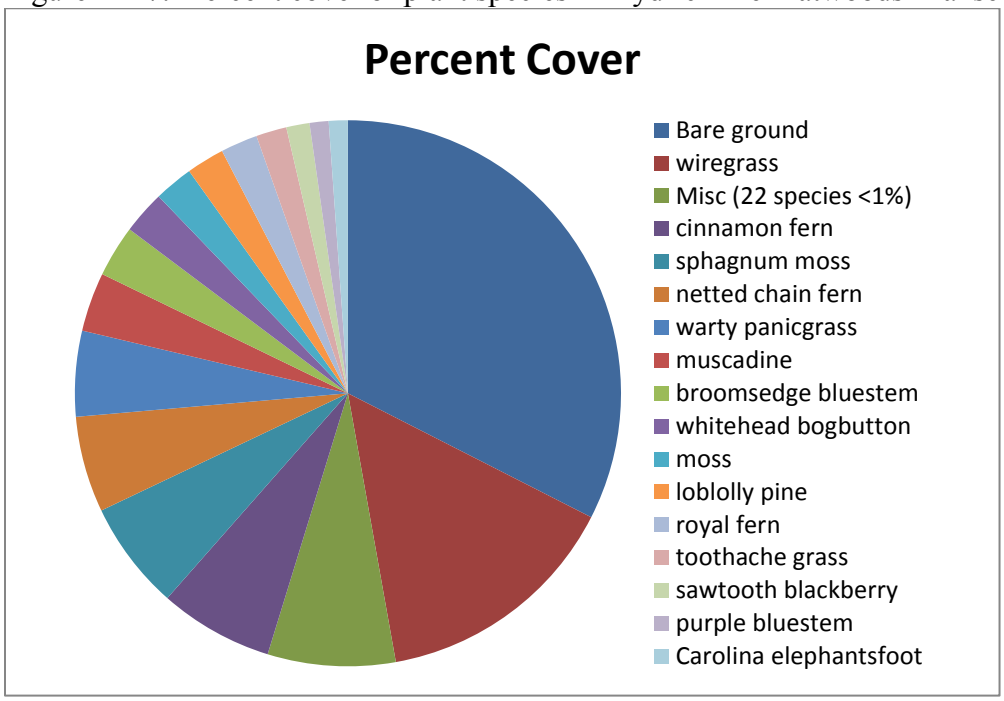

Table PR-7. Percent cover of plant species in Hydric Pine Flatwoods Transect 2 when sampled on November 9, 2015.

Scientific name	Common name	Average percent cover per quadrat
Aristida stricta var. *beyrichiana*	wiregrass	14.69
Osmunda cinnamomea	cinnamon fern	6.75
Sphagnum sp.	sphagnum moss	6.44
Woodwardia areolata	netted chain fern	5.69
Panicum verrucosum	warty panicgrass	5.06
Vitis rotundifolia	muscadine	3.50
Andropogon virginicus	broomsedge bluestem	3.06
Lachnocaulon anceps	whitehead bogbutton	2.56
moss	moss	2.31
Pinus taeda	loblolly pine	2.25
Osmunda regalis var. *spectabilis*	royal fern	2.19
Ctenium aromaticum	toothache grass	1.81

Scientific name	Common name	Average percent cover per quadrat
Rubus pensilvanicus	sawtooth blackberry	1.38
Andropogon glomeratus var. glaucopsis	purple bluestem	1.13
Elephantopus carolinianus	Carolina elephantsfoot	1.13
Eupatorium capillifolium	dogfennel	0.88
Eupatorium mohrii	Mohr's thoroughwort	0.88
Oldenlandia uniflora	clustered mille graines	0.88
Smilax glauca	cat greenbrier	0.88
Cyrilla racemiflora	titi	0.44
Euthamia caroliniana	slender flattop goldenrod	0.44
Persea palustris	swamp bay	0.44
Vaccinium elliottii	Elliott's blueberry	0.44
Woodwardia virginica	Virginia chain fern	0.44
Toxicodendron radicans	eastern poison ivy	0.38
Acer rubrum	red maple	0.19
Hypericum hypericoides	St. Andrew's cross	0.19
Hypericum tetrapetalum	fourpetal St. John's wort	0.19
Lycopus rubellus	taperleaf waterhorehound	0.19
Quercus nigra	water oak	0.19
Viola lanceolata	bog white violet	0.19
Dichanthelium sp.	witchgrass	0.06
Gaylussacia mosieri	woolly huckleberry	0.06
Hypericum cistifolium	roundpod St. John's wort	0.06
Ludwigia maritima	seaside primrosewillow	0.06
Solidago fistulosa	pinebarren goldenrod	0.06
Viola primulifolia	primroseleaf violet	0.06
	Bare ground	32.50

Pine Flatwoods

Qualitative monitoring. A total of 44 species (Table PR-1) were observed in the pine flatwoods area. The open canopy was dominated by mature loblolly pines 30-50 feet tall. The hardwoods in the subcanopy had been cut down the previous year and the logs remained on the ground. Some stumps had re-sprouted. Muscadine vine was abundant. The diverse open shrub layer was dominated by gallberry, large gallberry, wax myrtle, sawtooth blackberry, and Elliott's blueberry. In the herbaceous layer were scattered clumps of wiregrass, along with sphagnum moss, royal fern, cinnamon fern, netted chain fern, and Virginia chain fern.

Lafayette Creek – Phase I Mitigation Site

Qualitative and Quantitative Monitoring

December 2015

Lafayette Creek – Phase I Mitigation Site
Qualitative and Quantitative Monitoring
December 2015

INTRODUCTION

The Lafayette Creek Phase I Mitigation Site of 509 acres was obtained to compensate for the loss of wetland function from the impacts associated with US 331 re-alignment at Freeport. The site is located north of SR 20 and Lafayette Creek. Access to the site is via Hollington Road, which is located 4.5 miles east of US 331 on the north side of SR 20. The gate to the site is at the north end of Hollington Road. The Phase I Mitigation Project aims to restore sandhill (SA) to areas formerly planted with sand pine plantation and hydric savanna (HS) to areas of wetland shrubs (Figure LC-1). Quantitative and qualitative monitoring documented the current plant species composition and vegetation structure of these targeted communities. Qualitative monitoring was used to document areas of slash pine plantation being restored to high pine (HP) as well as the intact bay swamp (BS) and stream swamp (SS). The site vegetation was previously monitored by FNAI biologists in the fall of 2012, 2013, and 2014.

METHODS

The quantitative monitoring utilized 300-foot permanent transect lines previously marked during the 2012 survey. Two transects were located in both the sandhill and hydric savanna areas (Figure LC-1). In 2013, metal T-posts were installed at the ends of each transect to provide permanent reference points. In 2014 the northern metal T-post in hydric savanna Transect 2 was missing. Its position was re-established and the metal T-post was replaced. In 2015 the northern metal T-post in sandhill Transect 2 was missing. Its location was reestablished using the bearing from the remaining T-post and provisionally staked. Bearing and distances from witness trees were recorded for the endposts of this transect so their locations could be re-established if they were lost in the future. Data recorded consisted of the visually estimated percent cover of each plant species in fifteen 1-meter square quadrats. Tree trunks in quadrats were noted in comments but not recorded as cover; canopy over 2 m in height was also not recorded as cover in quadrats. The quadrats were located to the left of the transect line, 20 feet apart, starting at 0 feet and ending at 280 feet. The qualitative monitoring consisted of recording the species and vegetation structure observed along meandering pedestrian transects through each of these two communities plus high pine (HP), bay swamp (BS), and stream swamp (SS). The field surveys were performed by Gary Schultz and Ann Johnson on November 2-4, 2015.

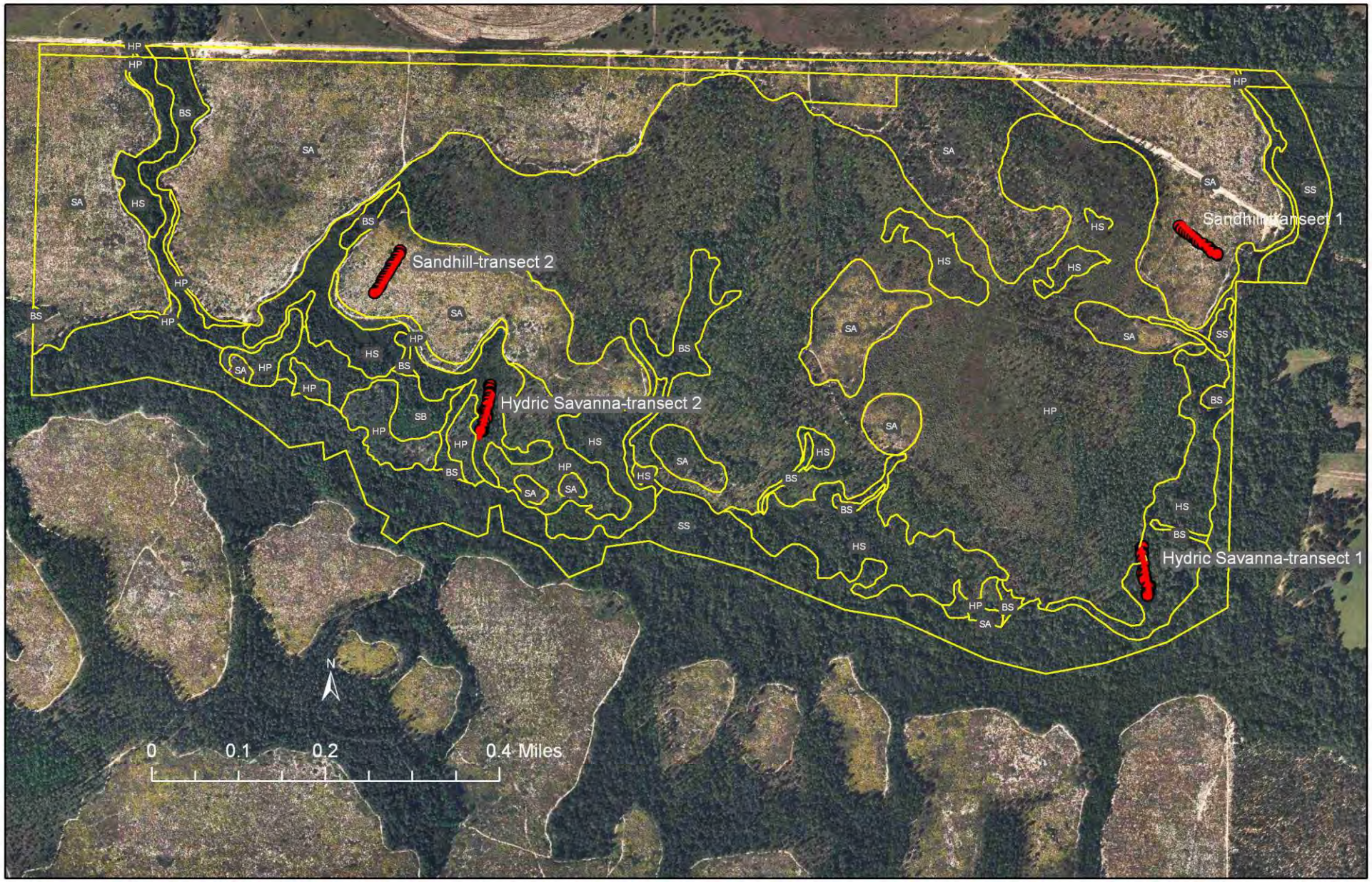

Figure LC-1. Location of permanent transects at Lafayette Creek – Phase I Mitigation Site. SA=Sandhill, HS=Hydric Savanna, HP=High Pine, BS=Bay Swamp, SS=Stream Swamp, SB=Shrub Bog.

RESULTS AND DISCUSSION

A total of 212 plant species were recorded in the surveyed areas of Lafayette Creek during the 2015 monitoring period (Table LC-1).

Sandhill

Qualitative sampling. The sandhill natural community has been degraded by past silviculture activities but retains many characteristic species. The diverse but somewhat sparse groundcover was dominated by wiregrass, needleleaf witchgrass, Lynn Haven goldenaster, little bluestem, and Piedmont gayfeather. Other common species included tapered witchgrass, broomsedge bluestem, and yankeeweed. The occasional shrubs were mainly woody goldenrod, young turkey oak, sand live oak, saw palmetto, yaupon, and sand blackberry. The vine earleaf greenbriar was common. Planted longleaf pines were common and ranged from 1 to 15 feet tall. A total of 96 plant species were identified in this community (Table LC-1).

Quantitative sampling. The eastern Transect 1 (Table LC-2, Figure LC-2) was located on an east- facing slope. It had a total of 44 species with 47% bare ground. Herbs and shrubs were about equally abundant. The herbs with the highest percent cover were wiregrass, needleleaf witchgrass, little bluestem and tapered witchgrass. The most abundant woody species were saw palmetto and sand live oak. The western Transect 2 (Table LC-3, Figure LC-3) was situated near the top of a ridge. It had a total of 30 species with 55% bare ground. Wiregrass, Lynn Haven goldenaster, and broomsedge bluestem were the dominant herbs. The open shrub stratum was mainly seedling and sapling longleaf pine. (NB: This transect was re-established in 2015 following loss of the northern end stake.)

Table LC-1. Species observed in target communities at Lafayette Creek – Phase I Mitigation Site, November 23, 2015.

Scientific Name	Common Name	bay swamp	high pine	hydric savanna	Sandhill	stream swamp	Grand Total
Acer rubrum	red maple	X				X	2
Agalinis divaricata	pineland flase foxglove				X		1
Agalinis fasciculata	beach false foxglove			X	X		2
Agalinis obtusifolia	tenlobe false foxglove				X		1
Aletris lutea	yellow colic-root			X			1
Alnus serrulata	hazel alder	X					1
Amsonia ciliata	fringed bluestar				X		1
Andropogon arctatus	pinewoods bluestem			X			1
Andropogon glomeratus	bushy bluestem			X			1
Andropogon glomeratus var. *glaucopsis*	purple bluestem		X	X			2
Andropogon gyrans	Elliott's bluestem				X		1
Andropogon gyrans var. *stenophyllus*	Elliott's bluestem			X			1
Andropogon sp.	bluestem				X		1

Scientific Name	Common Name	bay swamp	high pine	hydric savanna	Sandhill	stream swamp	Grand Total
Andropogon ternarius	splitbeard bluestem				X		1
Andropogon virginicus	broomsedge bluestem			X	X		2
Andropogon virginicus var. *glaucus*	chalky bluestem			X			1
Anthaenantia villosa	green silkyscale			X			1
Aristida condensata	big threeawn				X		1
Aristida mohrii	Mohr's threeawn				X		1
Aristida purpurascens	arrowfeather threeawn				X		1
Aristida stricta var. *beyrichiana*	wiregrass		X	X	X		3
Arnoglossum sulcatum	Georgia indian-plantain	X		X			2
Arundinaria gigantea	switchcane			X			1
Aureolaria pectinata	fernleaf yellow foxglove		X				1
Balduina angustifolia	coastalplain honeycomb-head				X		1
Baptisia lanceolata	gopherweed				X		1
Bidens mitis	smallfruit beggarticks			X			1
Bigelowia nudata	pineland rayless goldenrod			X			1
Bignonia capreolata	crossvine					X	1
Bulbostylis ciliatifolia	capillary hairsedge				X		1
Calamintha coccinea	scarlet calamint				X		1
Callicarpa americana	American beautyberry		X		X		2
Carex glaucescens	clustered sedge	X		X		X	3
Carphephorus odoratissimus	vanillaleaf		X				1
Centella asiatica	spadeleaf			X			1
Chamaecrista nictitans	sensitive pea			X			1
Chaptalia tomentosa	sunbonnets			X			1
Chrysoma pauciflosculosa	woody goldenrod				X		1
Chrysopsis lanuginosa	Lynn Haven goldenaster				X		1
Chrysopsis linearifolia	narrowleaf goldenaster				X		1
Cladina evansii	a lichen				X		1
Clematis virginiana	virginsbower				X		1
Clethra alnifolia	sweet pepperbush	X	X	X		X	4
Cliftonia monophylla	black titi	X		X			2
Cnidocolus stimulosus	tread softly				X		1
Croptilon divaricatum	slender scratchdaisy				X		1
Croton argyranthemus	silver croton				X		1
Ctenium aromaticum	toothache grass		X	X			2
Cyperus retrorsus	pinebarren flatsedge				X		1
Cyrilla racemiflora	titi		X			X	2
Dalea pinnata	summer farewell				X		1

Scientific Name	Common Name	bay swamp	high pine	hydric savanna	Sandhill	stream swamp	Grand Total
Dichanthelium aciculare	needleleaf witchgrass				X		1
Dichanthelium acuminatum	tapered witchgrass			X	X		2
Dichanthelium commutatum	variable witchgrass				X		1
Dichanthelium ensifolium	cypress witchgrass			X			1
Dichanthelium scabriusculum	woolly witchgrass			X		X	2
Dichanthelium sp.	witchgrass			X			1
Dichanthelium strigosum	roughhair witchgrass			X			1
Diodia virginiana	Virginia buttonweed			X			1
Diospyros virginiana	common persimmon				X		1
Drosera capillaris	pink sundew			X			1
Elephantopus sp.	elephantsfoot				X		1
Eragrostis elliottii	Elliott's lovegrass				X		1
Eragrostis virginica	coastal lovegrass				X		1
Eriocaulon compressum	flattened pipewort			X			1
Eriocaulon decangulare	tenangle pipewort	X		X			2
Eriogonum tomentosum	dogtongue wild buckwheat				X		1
Eupatorium capillifolium	dogfennel			X			1
Eupatorium compositifolium	yankeeweed				X		1
Eupatorium mohrii	Mohr's thoroughwort			X			1
Eupatorium pilosum	rough boneset			X			1
Eupatorium rotundifolium	roundleaf thoroughwort		X	X			2
Euphorbia discoidalis	summer spurge				X		1
Euphorbia floridana	greater Florida spurge				X		1
Eurybia eryngiifolia	thistleleaf aster		X				1
Euthamia caroliniana	slender flattop goldenrod		X	X			2
Fuirena breviseta	umbrellasedge			X			1
Galactia regularis	eastern milkpea				X		1
Galactia sp.	milkpea				X		1
Gaylussacia dumosa	dwarf huckleberry		X		X		2
Gelsemium sempervirens	yellow jessamine		X			X	1
Hamamelis virginiana	witch hazel	X					1
Helianthus angustifolius	narrowleaf sunflower			X			1
Helianthus radula	stiff sunflower		X		X		2
Hibiscus aculeatus	comfortroot		X				1
Houstonia procumbens	roundleaf bluet				X		1
Hypericum brachyphyllum	coastalplain St. John's wort	X		X			2
Hypericum gentianoides	orangegrass				X		1
Hypericum hypericoides	St. Andrew's cross			X	X	X	3

Scientific Name	Common Name	bay swamp	high pine	hydric savanna	Sandhill	stream swamp	Grand Total
Hypericum tetrapetalum	fourpetal St. John's wort			X			1
Ilex cassine	dahoon	X	X	X			3
Ilex coriacea	large gallberry	X		X			2
Ilex glabra	gallberry		X	X	X		3
Ilex opaca	American holly		X		X		2
Ilex vomitoria	yaupon		X		X		2
Itea virginica	Virginia willow					X	1
Juncus canadensis	Canada rush			X			1
Juncus trigonocarpus	redpod rush			X			1
Lachnanthes caroliana	Carolina redroot			X			1
Lachnocaulon anceps	whitehead bogbutton		X	X			2
Lechea sessilifolia	pineland pinweed				X		1
Leuchothoe axillaris	coastal doghobble					X	1
Liatris elegans	pinkscale gayfeather				X		1
Liatris gracilis	slender gayfeather				X		1
Liatris pauciflora var. *secunda*	Piedmont gayfeather				X		1
Liatris spicata	dense gayfeather			X			1
Liatris tenuifolia	shortleaf gayfeather				X		1
Licania michauxii	gopher apple				X		1
Liriodendron tulipifera	tuliptree			X		X	2
Lobelia brevifolia	shortleaf lobelia			X			1
Lophiola aurea	goldcrest			X			1
Ludwigia suffruticosa	shrubby primrosewillow			X			1
Lupinus diffusus	skyblue lupine				X		1
Lycopodiella alopecuroides	foxtail club-moss		X	X			2
Lyonia lucida	fetterbush	X				X	2
Magnolia virginiana	sweetbay	X	X	X			3
Mikania scandens	climbing hempvine					X	1
Mimosa quadrivalvis	sensitive briar				X		1
Muhlenbergia expansa	cutover muhly			X			1
Myrica caroliniensis	evergreen bayberry	X					1
Myrica inodora	odorless bayberry	X		X			2
Nyssa sylvatica var. *biflora*	swamp tupelo	X		X		X	3
Onoclea sensibilis	sensitive fern			X			1
Opuntia humifusa	pricklypear				X		1
Osmanthus americanus	wild olive				X		1
Osmunda cinnamomea	cinnamon fern	X	X	X		X	4
Osmunda regalis var. *spectabilis*	royal fern			X			1

Scientific Name	Common Name	bay swamp	high pine	hydric savanna	Sandhill	stream swamp	Grand Total
Panicum longifolium	panicum			X			1
Panicum verrucosum	warty panicgrass			X			1
Panicum virgatum	switchgrass			X	X		2
Paspalum setaceum	thin paspalum				X		1
Persea palustris	swamp bay		X				1
Pinus clausa	sand pine				X		1
Pinus elliottii	slash pine	X	X	X	X		4
Pinus palustris	longleaf pine		X		X		2
Pinus serotina	pond pine	X		X			2
Pinus taeda	loblolly pine			X		X	2
Pityopsis aspera	pineland silkgrass				X		1
Pityopsis graminifolia	narrowleaf silkgrass		X		X		2
Polygonella gracilis	tall jointweed				X		1
Pteridium aquilinum	bracken fern		X	X			2
Pseudognaphalium obtusifolium	sweet everlasting				X		1
Pteridium aquilinum	bracken		X	X			2
Pterocaulon pycnostachyum	blackroot		X				1
Quercus geminata	sand live oak			X	X		2
Quercus hemisphaerica	laurel oak				X		1
Quercus incana	bluejack oak				X		1
Quercus laevis	turkey oak				X		1
Quercus margarettae	sand post oak				X		1
Quercus minima	dwarf live oak		X		X		2
Quercus nigra	water oak	X					1
Quercus pumila	runner oak		X				1
Rhexia alifanus	tall meadowbeauty			X			1
Rhexia petiolata	fringed meadowbeauty			X			1
Rhexia sp.	meadowbeauty			X			1
Rhexia virginica	handsome harry			X			1
Rhododendron viscosum	swamp azalea	X					1
Rhus copallinum	winged sumac				X		1
Rhynchosia cytisoides	royal snoutbean				X		1
Rhynchospora cephalantha	bunched beaksedge			X			1
Rhynchospora chalarocephala	loosehead beaksedge			X			1
Rhynchospora chapmanii	Chapman's beaksedge			X			1
Rhynchospora compressa	flatfruit beaksedge			X			1
Rhynchospora fascicularis	fascicled beaksedge			X			1
Rhynchospora sp.	beaksedge			X			1

Scientific Name	Common Name	bay swamp	high pine	hydric savanna	Sandhill	stream swamp	Grand Total
Rubus pensilvanicus	sawtooth blackberry	X		X			2
Rubus cuneifolius	sand blackberry		X		X		2
Ruellia ciliosa	ciliate wild petunia				X		1
Saccharum giganteum	sugarcane plumegrass			X			1
Sarracenia leucophylla	white-top pitcherplant			X			1
Schizachyrium sanguineum	crimson bluestem			X			1
Schizachyrium scoparium	little bluestem				X		1
Schizachyrium tenerum	slender bluestem				X		1
Scirpus cyperinus	woolgrass			X			1
Scleria ciliata	fringed nutrush				X		1
Scleria reticularis	netted nutrush			X			1
Scleria triglomerata	whip nutrush			X			1
Scoparia dulcis	licoriceweed			X			1
Serenoa repens	saw palmetto	X	X	X	X		4
Sericocarpus tortifolius	whitetop aster				X		1
Seymeria cassioides	yaupon blacksenna				X		1
Smilax auriculata	earleaf greenbrier				X		1
Smilax glauca	cat greenbrier	X	X	X			3
Smilax laurifolia	laurel greenbrier	X	X	X			3
Solidago fistulosa	pinebarren goldenrod			X			1
Solidago odora	sweet goldenrod		X		X		2
Solidago stricta	wand goldenrod			X			1
Sphagnum sp.	sphagnum moss	X		X			2
Stillingia sylvatica	queen's delight				X		1
Symphyotrichum adnatum	scaleleaf aster		X				1
Symphyotrichum concolor	eastern silver aster				X		1
Symphyotrichum dumosum	rice button aster		X	X	X		3
Symplocos tinctoria	horse sugar					X	1
Taxodium ascendens	pond cypress					X	1
Tephrosia chrysophylla	scurf hoary-pea				X		1
Tephrosia virginiana	goat's rue				X		1
Toxicodendron radicans	eastern poison ivy		X				1
Toxicodendron vernix	poison sumac					X	1
Tragia sp.	wavyleaf noseburn				X		1
Utricularia juncea	southern bladderwort			X			1
Vaccinium arboreum	sparkleberry		X		X		2
Vaccinium corymbosum	highbush blueberry	X	X				2
Vaccinium elliottii	Elliott's blueberry				X		1

Scientific Name	Common Name	bay swamp	high pine	hydric savanna	Sandhill	stream swamp	Grand Total
Vaccinium myrsinites	shiny blueberry		X		X		2
Viola primulifolia	primroseleaf violet			X			1
Viola sororia	common blue violet					X	1
Vitis rotundifolia	muscadine	X	X	X	X	X	5
Woodwardia areolata	netted chain fern					X	1
Woodwardia virginica	Virginia chain fern	X	X	X			3
Xyris ambigua	coastalplain yellow-eyed grass			X			1
Xyris fimbriata	fringed yellow-eyed grass			X		X	2
Yucca filamentosa	Adam's needle				X		1
Total number of taxa: 212		29	45	100	96	23	293

Figure LC-2. Percent cover of plant species in Sandhill Transect 1.

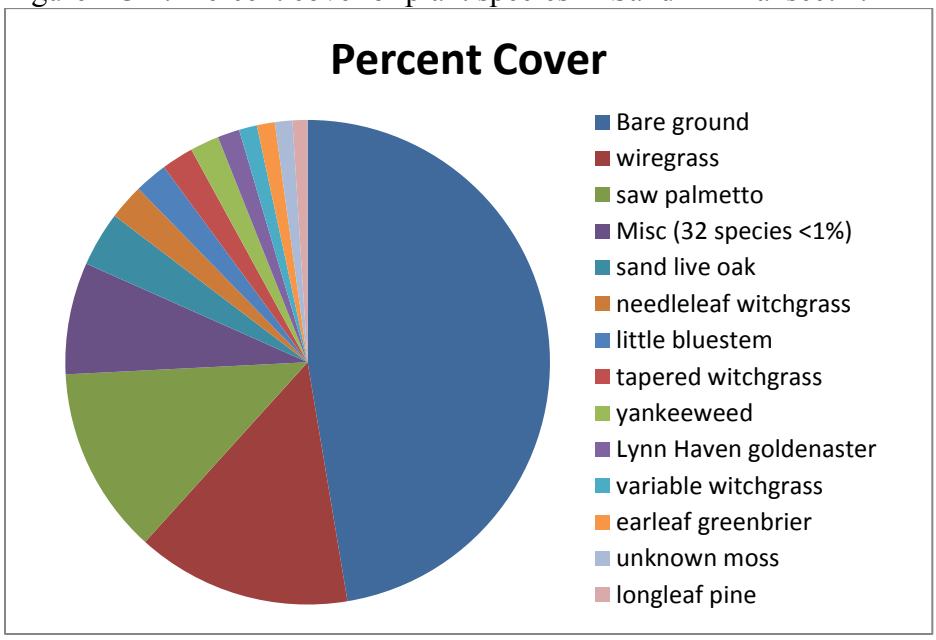

Table LC-2. Percent cover of plant species in Sandhill Transect 1 when sampled on November 2, 2015.

Scientific name	Common name	Average percent cover per quadrat
Aristida stricta var. *beyrichiana*	wiregrass	14.33
Serenoa repens	saw palmetto	12.50
Quercus geminata	sand live oak	3.67
Dichanthelium aciculare	needleleaf witchgrass	2.37
Schizachyrium scoparium	little bluestem	2.20

Scientific name	Common name	Average percent cover per quadrat
Dichanthelium acuminatum	tapered witchgrass	2.13
Eupatorium compositifolium	yankeeweed	1.93
Chrysopsis lanuginosa	Lynn Haven goldenaster	1.47
Dichanthelium commutatum	variable witchgrass	1.20
Smilax auriculata	earleaf greenbrier	1.20
unknown moss	unknown moss	1.17
Pinus palustris	longleaf pine	1.00
Schizachyrium tenerum	slender bluestem	0.83
Quercus minima	dwarf live oak	0.77
Polygonella gracilis	tall jointweed	0.63
Solidago odora	sweet goldenrod	0.63
Hypericum gentianoides	orangegrass	0.50
Rubus pensilvanicus	sawtooth blackberry	0.50
Rhus copallinum	winged sumac	0.47
Licania michauxii	gopher apple	0.43
Paspalum setaceum	thin paspalum	0.40
Pityopsis aspera	pineland silkgrass	0.37
Eragrostis virginica	coastal lovegrass	0.33
Aristida purpurascens	arrowfeather threeawn	0.27
Opuntia humifusa	pricklypear	0.23
Rubus cuneifolius	sand blackberry	0.17
Bulbostylis ciliatifolia	capillary hairsedge	0.13
Mimosa quadrivalvis	sensitive briar	0.13
Galactia regularis	eastern milkpea	0.10
Liatris pauciflora var. *secunda*	Piedmont gayfeather	0.07
Cnidoscolus stimulosus	tread softly	0.07
Euphorbia discoidalis	summer spurge	0.03
Aristida mohrii	Mohr's threeawn	0.03
Vaccinium myrsinites	shiny blueberry	0.03
Andropogon ternarius	splitbeard bluestem	0.03
Scleria ciliata	fringed nutrush	0.03
Liatris tenuifolia	shortleaf gayfeather	0.03
Rhynchosia cytisoides	royal snoutbean	0.03
Stylisma patens	coastalplain dawnflower	0.03
Andropogon sp.	bluestem	0.03
Pseudognaphalium obtusifolium	sweet everlasting	0.03
Ruellia ciliosa	ciliate wild petunia	0.03
Liatris pauciflora var. *secunda*	fewflower gayfeather	0.03
Eriogonum tomentosum	dogtongue wild buckwheat	0.03
	Bare ground	47.37

Figure LC-3. Percent cover of plant species in Sandhill Transect 2.

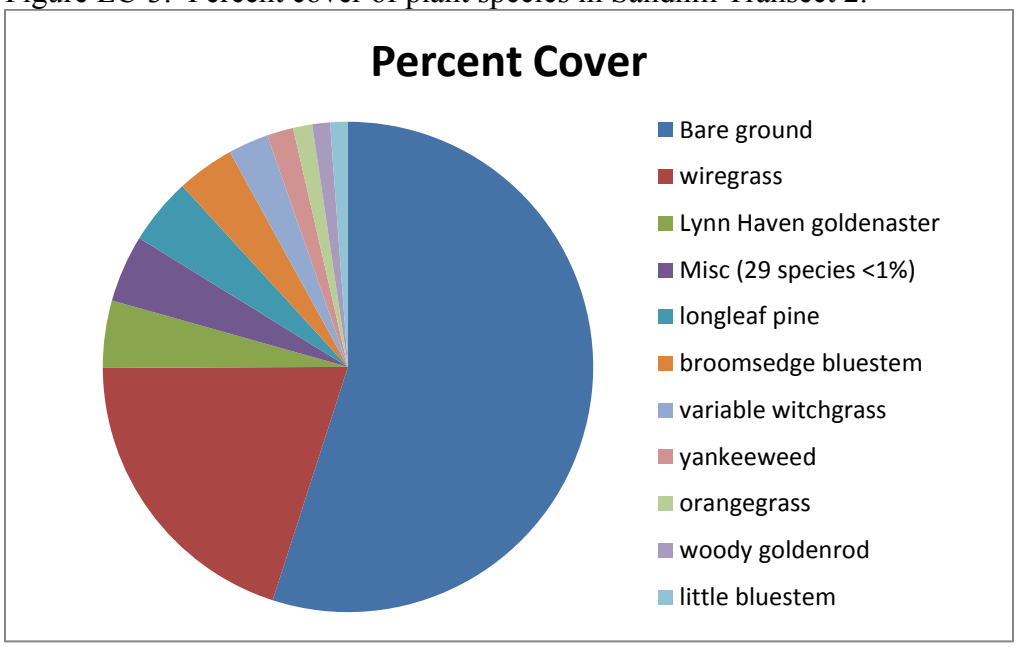

Table LC-3. Percent cover of plant species in Sandhill Transect 2 when sampled on November 3, 2015.

Scientific name	Common name	Average percent cover per quadrat
Aristida stricta var. *beyrichiana*	wiregrass	19.97
Chrysopsis lanuginosa	Lynn Haven goldenaster	4.43
Pinus palustris	longleaf pine	4.40
Andropogon virginicus	broomsedge bluestem	3.80
Dichanthelium commutatum	variable witchgrass	2.67
Eupatorium compositifolium	yankeeweed	1.73
Hypericum gentianoides	orangegrass	1.27
Chrysoma pauciflosculosa	woody goldenrod	1.17
Schizachyrium scoparium	little bluestem	1.17
Aristida purpurascens	arrowfeather threeawn	0.73
Polygonella gracilis	tall jointweed	0.67
Bulbostylis ciliatifolia	capillary hairsedge	0.67
Smilax auriculata	earleaf greenbrier	0.60
Dichanthelium acuminatum	tapered witchgrass	0.47
Aristida mohrii	Mohr's threeawn	0.23
Eriogonum tomentosum	dogtongue wild buckwheat	0.20
Rubus pensilvanicus	sawtooth blackberry	0.10
Quercus laevis	turkey oak	0.10
Andropogon sp.	bluestem	0.10

Scientific name	Common name	Average percent cover per quadrat
Licania michauxii	gopher apple	0.10
Serenoa repens	saw palmetto	0.10
Andropogon gyrans	Elliott's bluestem	0.10
Mimosa quadrivalvis	sensitive briar	0.03
Liatris tenuifolia	shortleaf gayfeather	0.03
Liatris pauciflora var. secunda	Piedmont gayfeather	0.03
Galactia sp.	milkpea	0.03
Galactia regularis	eastern milkpea	0.03
Gaylussacia dumosa	dwarf huckleberry	0.03
Euphorbia discoidalis	summer spurge	0.03
Euphorbia floridana	greater Florida spurge	0.03
	Bare ground	54.97

Hydric Savanna

Qualitative sampling. The restoration of the fire-suppressed hydric savanna was begun in 2010 by mowing down the often dense shrubs with a Gyro-Trac machine. Follow-up prescribed burning had further reduced the shrub strata. As a result, much of the ground was bare or sparsely vegetated and there was some disturbance by vehicle tracks in the two sampling periods prior to 2014. In 2014 warty panicum and Chapman's beaksedge colonized a portion of the formerly bare area. Occasional areas with water seepage at the bottom of the sandhill ridge had whitetop pitcher-plants and abundant beaksedges. A wide variety of herbs were colonizing the rest of the area, with beaksedges dominating in the wetter sections and wiregrass in the drier parts. The sparse shrubs include black titi, large gallberry, sweet pepperbush, and gallberry. Scattered mature pond pine provided an open canopy. The soil was often saturated and small areas of inundation were found at the lower elevations. A total of 100 species were recorded from this community (Table LC-1), an increase over the prior two years. Pine-woods bluestem (*Andropogon arctatus*), state-listed as threatened, was noted in this community in 2015.

Quantitative sampling. The eastern Transect 1 (Table LC-4, Figure LC-4) was on a south-facing slope and had a total of 43 species with 47% bare ground. Herbaceous cover made up most of the transect. The most abundant herbs were roughhair witchgrass, wiregrass, and warty panicgrass. Purple bluestem and pinewoods bluestem were also common. The western Transect 2 (Table LC-5, Figure LC-5) was also on a south facing slope. It had a total of 31 species with 42% bare ground. The drier north end had abundant purple bluestem and wiregrass, while the wetter south end was dominated by Chapman's beaksedge and warty panicgrass.

Figure LC-4. Percent cover of plant species in Hydric Savanna Transect 1.

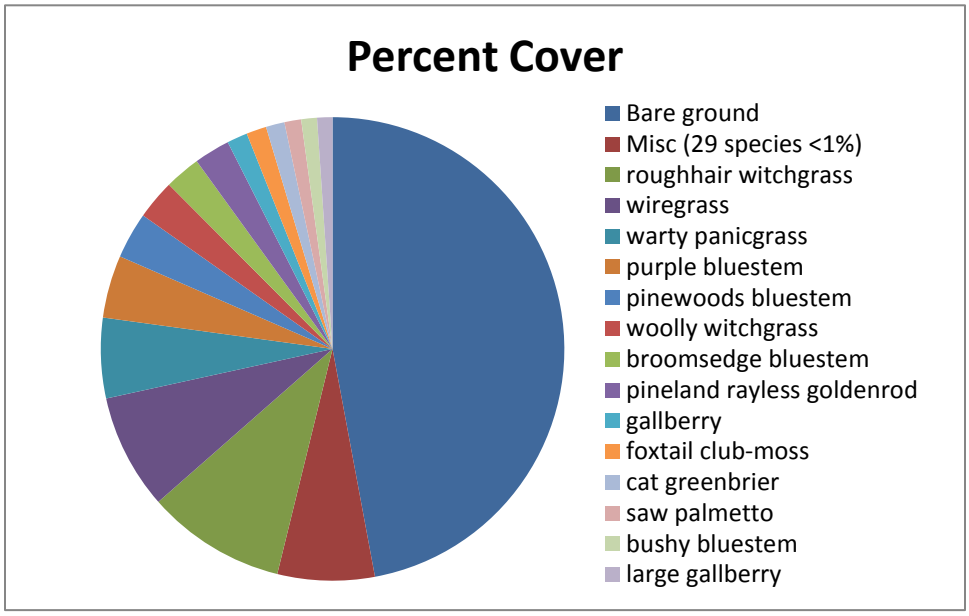

Table LC-4. Percent cover of plant species in Hydric Savanna Transect 1 when sampled on November 4, 2015.

Scientific name	Common name	Average percent cover per quadrat
Dichanthelium strigosum	roughhair witchgrass	9.70
Aristida stricta var. beyrichiana	wiregrass	8.03
Panicum verrucosum	warty panicgrass	5.60
Andropogon glomeratus var. *glaucopsis*	purple bluestem	4.37
Andropogon arctatus	pinewoods bluestem	3.23
Dichanthelium scabriusculum	woolly witchgrass	2.77
Andropogon virginicus	broomsedge bluestem	2.50
Bigelowia nudata	pineland rayless goldenrod	2.50
Ilex glabra	gallberry	1.43
Lycopodiella alopecuroides	foxtail club-moss	1.40
Smilax glauca	cat greenbrier	1.30
Serenoa repens	saw palmetto	1.17
Andropogon glomeratus	bushy bluestem	1.10
Ilex coriacea	large gallberry	1.07
Xyris ambigua	coastalplain yellow-eyed grass	0.83
Cliftonia monophylla	black titi	0.80
Rhynchospora fascicularis	fascicled beaksedge	0.70
Hypericum brachyphyllum	coastalplain St. John's wort	0.50
Panicum longifolium	panicum	0.50
Rhynchospora chapmanii	Chapman's beaksedge	0.47
Rhynchospora compressa	flatfruit beaksedge	0.27

Scientific name	Common name	Average percent cover per quadrat
Schizachyrium sanguineum	crimson bluestem	0.23
Eupatorium mohrii	Mohr's thoroughwort	0.23
Andropogon virginicus var. *glaucus*	chalky bluestem	0.23
Helianthus angustifolius	narrowleaf sunflower	0.23
Ctenium aromaticum	toothache grass	0.23
Eupatorium pilosum	rough boneset	0.23
Aletris lutea	yellow colic-root	0.23
Pinus elliottii	slash pine	0.13
Osmunda regalis var. *spectabilis*	royal fern	0.10
Vaccinium arboreum	sparkleberry	0.10
Euthamia caroliniana	slender flattop goldenrod	0.10
Arundinaria gigantea	switchcane	0.10
Rhexia alifanus	savannah meadowbeauty	0.10
Rhexia petiolata	fringed meadowbeauty	0.10
Lachnanthes caroliana	Carolina redroot	0.10
Callicarpa americana	American beautyberry	0.03
Eriocaulon compressum	flattened pipewort	0.03
Smilax laurifolia	laurel greenbrier	0.03
Gaylussacia dumosa	dwarf huckleberry	0.03
Rubus pensilvanicus	sawtooth blackberry	0.03
Rhexia sp.	meadowbeauty	0.03
Hypericum tetrapetalum	fourpetal St. John's wort	0.03
	Bare ground	47.07

Figure LC-5. Percent cover of plant species in Hydric Savanna Transect 2.

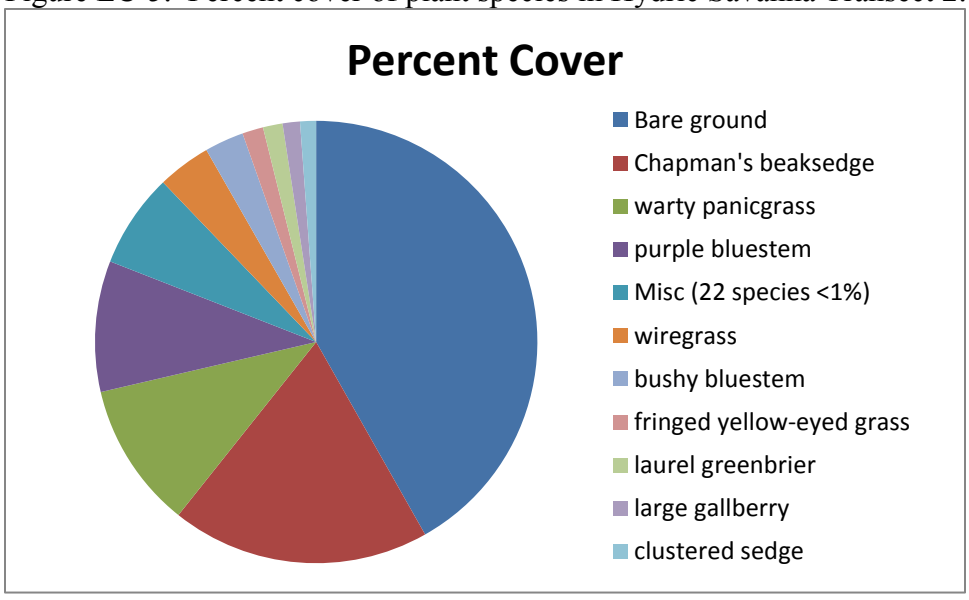

Table LC-5. Percent cover of plant species in Hydric Savanna Transect 2 when sampled on November 3, 2015

Scientific name	Common name	Average percent cover per quadrat
Rhynchospora chapmanii	Chapman's beaksedge	18.90
Panicum verrucosum	warty panicgrass	10.67
Andropogon glomeratus var. glaucopsis	purple bluestem	9.57
Aristida stricta var. beyrichiana	wiregrass	3.90
Andropogon glomeratus	bushy bluestem	2.87
Xyris fimbriata	fringed yellow-eyed grass	1.53
Smilax laurifolia	laurel greenbrier	1.43
Ilex coriacea	large gallberry	1.27
Carex glaucescens	clustered sedge	1.17
Dichanthelium sp.	witchgrass	0.77
Pteridium aquilinum	bracken fern	0.73
Cliftonia monophylla	black titi	0.60
Smilax glauca	cat greenbrier	0.53
Rhynchospora cephalantha	bunched beaksedge	0.53
Hypericum brachyphyllum	coastalplain St. John's wort	0.50
Rhynchospora chalarocephala	loosehead beaksedge	0.50
Clethra alnifolia	sweet pepperbush	0.33
Vaccinium corymbosum	highbush blueberry	0.23
Rhynchospora sp.	beaksedge	0.23
Lycopodiella alopecuroides	foxtail club-moss	0.23
Nyssa sylvatica var. biflora	swamp tupelo	0.23
Lachnanthes caroliana	Carolina redroot	0.23
Pinus elliottii	slash pine	0.23
Magnolia virginiana	sweetbay	0.23
Eupatorium capillifolium	dogfennel	0.20
Eriocaulon compressum	flattened pipewort	0.20
Dichanthelium ensifolium	cypress witchgrass	0.10
Utricularia juncea	southern bladderwort	0.10
Rhynchospora compressa	flatfruit beaksedge	0.10
Rhexia sp.	meadowbeauty	0.03
Ludwigia suffruticosa	shrubby primrosewillow	0.03
	Bare ground	41.80

High Pine

Qualitative sampling. Mature slash pine plantation still covers most of the area being restored to high pine. Thinning of the pines and prescribed fire had opened up the canopy in some

sections. An often dense shrub layer was dominated by gallberry, yaupon, American beautyberry, and large gallberry. More open areas had wiregrass, purple bluestem, plus many other herbs including toothache grass, thistleleaf aster, scaleleaf aster, glade lobelia, and vanillaleaf. The total number of species observed in this community was 45 (Table LC-1).

Bay Swamp

Qualitative sampling. This relatively undisturbed natural community occurs as a narrow band along the small stream tributaries to Lafayette Creek. The often dense canopy consisted of sweetbay, swamp bay, black titi, water oak, and swamp tupelo. The also dense shrub layer was primarily fetterbush, large gallberry, black titi, plus odorless bayberry, sweet pepperbush, evergreen bayberry, and wild olive. Cinnamon fern was in the sparse herb stratum and laurel greenbrier was a common vine. The total number of species observed in this community was 29 (Table LC-1).

Stream Swamp

Qualitative sampling. This relatively undisturbed natural community occurred along the narrow floodplain of Lafayette Creek and its major tributary, Wolf Creek. The closed canopy was composed of water oak, swamp bay, and sweetbay. The often dense shrubs consisted of titi, black titi, large gallberry, odorless bayberry, and fetterbush. Sphagnum moss, cinnamon fern, and royal fern made up the sparse groundcover. The total number of species observed in this community was 23 (Table LC-1).

Plum Creek at Holmes Creek Mitigation Site

Qualitative and Quantitative Monitoring

December 2015

Plum Creek at Holmes Creek Mitigation Site
Qualitative and Quantitative Monitoring
December 2015

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. The 130-acre tract lies just north of Holmes Creek and is contiguous with other Northwest Florida Water Management District holdings along the creek. Access is by going south on SR 79 for 6.3 miles from I-10 to Johnson Road. Head east on Johnson Road to the gate on the south side of the winding road. The Plum Creek Mitigation project aims to restore sandhill (SA) from pine plantation and mixed forested wetlands (MFW) from a wetland impacted by a beaver pond (Figure PC-1). Quantitative and qualitative monitoring documented the current plant species composition and vegetation structure of the communities targeted for restoration as well as an intact mixed forested wetland community. The site vegetation was previously monitored by FNAI biologists in the fall of 2012, 2013, and 2014.

METHODS

The quantitative monitoring utilized 300-foot- long permanent transect lines previously marked during the 2012 survey. Two transects were located in the sandhill, one in the restoration mixed forested wetland, and one in preserved mixed forested wetland (Figure PC-1). In 2013, metal T-posts were installed at the ends of each transect to provide more permanent reference points. Data recorded consisted of the visually estimated percent cover of each plant species in fifteen 1-meter square quadrats. Tree trunks in quadrats were noted in comments but not recorded as cover; canopy over 2 m in height was also not recorded as cover in quadrats. Quadrats were located to the left of the transect line and placed 20 feet apart, starting at 0 feet and ending at 280 feet. The qualitative monitoring consisted of recording the species and vegetation structure observed along meandering pedestrian transects through each of these communities. The field surveys were performed by FNAI botanists, Gary Schultz and Ann Johnson on November 4 and 5, 2015.

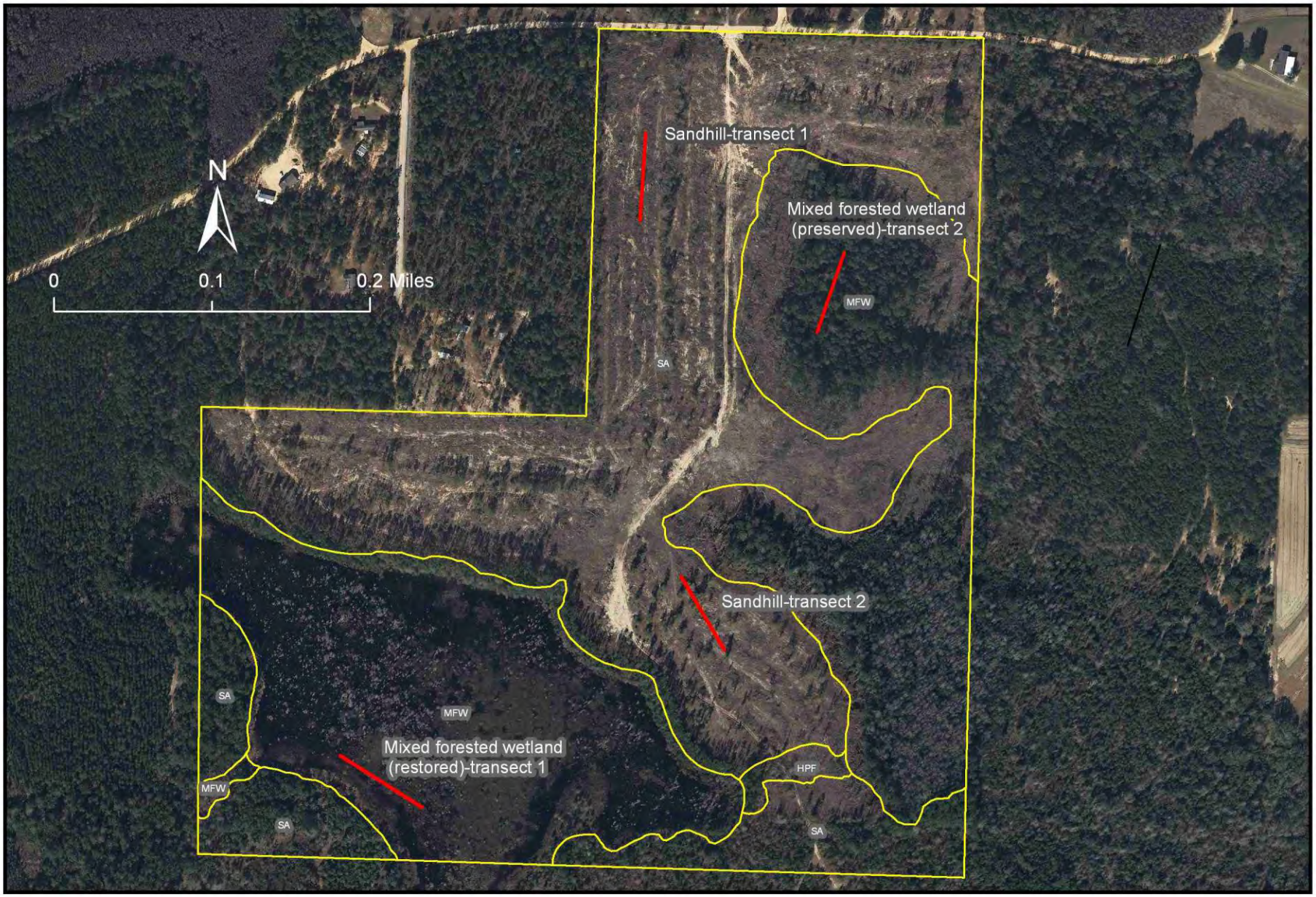

Figure PC-1. Location of permanent transects at Plum Creek at Holmes Creek Mitigation Site in Sandhill and Mixed Forested Wetland,

RESULTS AND DISCUSSION

A total of 128 plant species were observed during the 2015 monitoring period in the target communities at Plum Creek at Holmes Creek Mitigation Site (Table PC-1).

Sandhill

Qualitative sampling. The sandhill natural community has been degraded by past silviculture activities but retains many characteristic species. Young planted longleaf pines were spaced over the hillside. The diverse but somewhat sparse groundcover included wiregrass, broomsedge bluestem, little bluestem, and needleleaf witchgrass. The occasional shrubs were mainly sand live oak, yaupon, turkey oak, sparkleberry, and sand blackberry. The vine earleaf greenbriar was common. A total of 88 plant species were identified in this community (Table PC-1).

Quantitative sampling. The northern Transect 1 (Table PC-2, Figure PC-2) was located midslope on an east-facing hill. It had a total of 44 species with 55% bare ground. The herbs with the highest percent cover were and broomsedge bluestem, Lynn Haven goldenaster, and wiregrass. Shrubs were sparse, the most abundant being yaupon. The southern Transect 2 (Table PC-3, Figure PC-3) was situated near the top of a low ridge. It had a total of 38 species with 21% bare ground. Common herbs included Lynn Haven goldenaster, rustweed, and needleleaf witchgrass. The common woody species were longleaf pine saplings, saw palmetto, and sawtooth blackberry. Bearings and distances to nearby longleaf saplings were taken to allow re-location of the endpoints of this transect.

Table PC-1. Plant species observed in target communities at Plum Creek at Holmes Creek Mitigation Site November 4 and 5, 2015.

Scientific Name	Common Name	Sandhill	Mixed Forested Wetland-Restoration	Mixed Forested Wetland-Preserved	Grand Total
Acer rubrum	red maple		X		1
Andropogon glomeratus var. glaucopsis	purple bluestem	X	X		2
Andropogon sp.	bluestem	X			1
Andropogon ternarius	splitbeard bluestem	X			1
Andropogon virginicus	broomsedge bluestem	X	X		2
Apteria aphylla	nodding nixie			X	1
Aristida purpurascens	arrowfeather threeawn	X			1
Aristida purpurascens	arrowfeather threeawn	X			1
Aristida stricta var. beyrichiana	wiregrass	X			1
Asimina angustifolia	slimleaf pawpaw	X			1
Baccharis halimifolia	groundsel tree	X			1
Baptisia lanceolata	gopherweed	X			1
Berlandiera pumila	soft greeneyes	X			1
Bidens mitis	smallfruit beggarticks		X		1

Scientific Name	Common Name	Sandhill	Mixed Forested Wetland-Restoration	Mixed Forested Wetland-Preserved	Grand Total
Bulbostylis ciliatifolia	capillary hairsedge	X			1
Callicarpa americana	American beautyberry	X			1
Carex glaucescens	clustered sedge			X	1
Carex sp.	sedge		X	X	2
Carphephorus odoratissimus	vanillaleaf	X			1
Cephalanthus occidentalis	common buttonbush		X		1
Chamaecrista fasciculata	partridge pea	X			1
Chrysoma pauciflosculosa	woody goldenrod	X			1
Chrysopsis lanuginosa	Lynn Haven goldenaster	X			1
Cladina evansii	a lichen	X			1
Clethra alnifolia	sweet pepperbush			X	1
Cliftonia monophylla	black titi			X	1
Cnidoscolus stimulosus	tread softly	X			1
Cyperus retrorsus	pinebarren flatsedge	X			1
Cyperus sp.	flatsedge	X			1
Cyrilla racemiflora	titi			X	1
Dalea pinnata	summer farewell	X			1
Decodon verticillatus	willow herb		X		1
Dichanthelium aciculare	needleleaf witchgrass	X			1
Dichanthelium acuminatum	tapered witchgrass	X			1
Dichanthelium commutatum	variable witchgrass	X			1
Dichanthelium portoricense	hemlock witchgrass	X			1
Dichanthelium sp.	witchgrass	X			1
Diospyros virginiana	common persimmon	X			1
Dulichium arundinaceum	threeway sedge		X		1
Eleocharis equisetoides	jointed spikerush		X		1
Elephantopus elatus	tall elephantsfoot	X			1
Eragrostis spectabilis	purple lovegrass	X			1
Eragrostis virginica	coastal lovegrass	X			1
Eupatorium capillifolium	dogfennel	X			1
Eupatorium compositifolium	yankeeweed	X			1
Eupatorium pilosum	rough boneset		X		1
Euthamia caroliniana	slender flattop goldenrod	X			1
Galactia sp.	milkpea	X			1
Galium hispidulum	coastal bedstraw	X			1
Gaura sp.	beeblossom	X			1
Gaylussacia dumosa	dwarf huckleberry	X			1
Gelsemium sempervirens	yellow jessamine	X			1
Hieracium sp.	hawkweed	X			1

Scientific Name	Common Name	Sandhill	Mixed Forested Wetland-Restoration	Mixed Forested Wetland-Preserved	Grand Total
Houstonia procumbens	roundleaf bluet	X			1
Hypericum brachyphyllum	coastalplain St. John's wort		X		1
Hypericum gentianoides	orangegrass	X			1
Hypericum hypericoides	St. Andrew's cross	X			1
Ilex coriacea	large gallberry			X	1
Ilex glabra	gallberry	X			1
Ilex opaca	American holly	X			1
Ilex vomitoria	yaupon	X			1
Itea virginica	Virginia willow		X		1
Juncus canadensis	Canadian rush		X		1
Juniperus virginiana	red cedar	X			1
Lechea sp.	pineland pinweed	X			1
Liatris gracilis	slender gayfeather	X			1
Liatris pauciflora var. secunda	Piedmont gayfeather	X			1
Liquidambar styraciflua	sweetgum			X	1
Ludwigia suffruticosa	shrubby primrosewillow		X		1
Lycopus rubellus	taperleaf waterhorehound		X		1
Lyonia lucida	fetterbush			X	1
Magnolia virginiana	sweetbay		X	X	2
Myrica cerifera	wax myrtle		X		1
Nymphoides aquatica	big floatingheart		X		1
Nyssa sylvatica var. biflora	swamp tupelo		X	X	2
Osmanthus americanus	wild olive	X		X	2
Osmunda cinnamomea	cinnamon fern			X	1
Panicum hemitomon	maidencane		X		1
Panicum virgatum	switchgrass	X			1
Persea palustris	swamp bay			X	1
Pinus elliottii	slash pine	X			1
Pinus palustris	longleaf pine	X			1
Pinus serotina	pond pine			X	1
Pityopsis aspera	pineland silkgrass	X			1
Pluchea longifolia	longleaf camphorweed			X	1
Pluchea sp.	camphorweed	X			1
Polygonella gracilis	tall jointweed	X			1
Polypremum procumbens	rustweed	X			1
Pseudognaphalium obtusifolium	sweet everlasting	X			1
Pteridium aquilinum	bracken fern	X			1
Quercus falcata	southern red oak	X			1
Quercus geminata	sand live oak	X			1

Scientific Name	Common Name	Sandhill	Mixed Forested Wetland-Restoration	Mixed Forested Wetland-Preserved	Grand Total
Quercus hemisphaerica	laurel oak	X			1
Quercus incana	bluejack oak	X			1
Quercus laevis	turkey oak	X			1
Quercus margaretta	sand post oak	X			1
Rhexia petiolata	fringed meadowbeauty		X		1
Rhododendron canescens	mountain azalea			X	1
Rhynchospora cephalantha	bunched beaksedge			X	1
Rhynchospora chalarocephala	loosehead beaksedge		X		1
Rhynchospora nitens	shortbeak beaksedge		X		1
Rubus cuneifolius	sand blackberry	X			1
Saccharum giganteum	sugarcane plumegrass		X	X	2
Salvia azurea	azure blue sage	X			1
Sapium sebiferum	Chinese tallow			X	1
Schizachyrium scoparium	little bluestem	X			1
Scleria ciliata	fringed nutrush	X			1
Serenoa repens	saw palmetto	X			1
Sericocarpus tortifolius	whitetop aster	X			1
Smilax auriculata	earleaf greenbrier	X			1
Smilax glauca	cat greenbrier	X			1
Smilax laurifolia	laurel greenbrier	X		X	2
Smilax pumila	sarsaparilla vine	X			1
Solidago fistulosa	pinebarren goldenrod		X		1
Solidago odora	sweet goldenrod	X			1
Solidago sp.	goldenrod	X			1
Solidago stricta	wand goldenrod	X			1
Sphagnum sp.	sphagnum moss			X	1
Symphyotrichum concolor	eastern silver aster	X			1
Symphyotrichum dumosum	rice button aster	X			1
Taxodium ascendens	pond cypress		X		1
Triadenum virginicum	Virginia marsh St. John's wort		X		1
Trichostema dichotomum	forked bluecurls	X			1
unknown grass	unknown grass	X			1
unknown herb	unknown herb	X			1
unknown moss	unknown moss			X	1
Vaccinium arboreum	sparkleberry	X			1
Vaccinium corymbosum	highbush blueberry			X	1
Vaccinium stamineum	deerberry	X			1
Vernonia angustifolia	tall ironweed	X			1
Vitis rotundifolia	muscadine	X		X	2

Scientific Name	Common Name	Sandhill	Mixed Forested Wetland-Restoration	Mixed Forested Wetland-Preserved	Grand Total
Woodwardia areolata	netted chain fern			X	1
Woodwardia virginica	Virginia chain fern		X		1
Xyris ambigua	coastalplain yellow-eyed grass		X		1
Xyris fimbriata	fringed yellow-eyed grass		X		1
Total number of species: 128		88	30	26	144

Figure PC-2. Percent cover of plant species in Sandhill Transect 1.

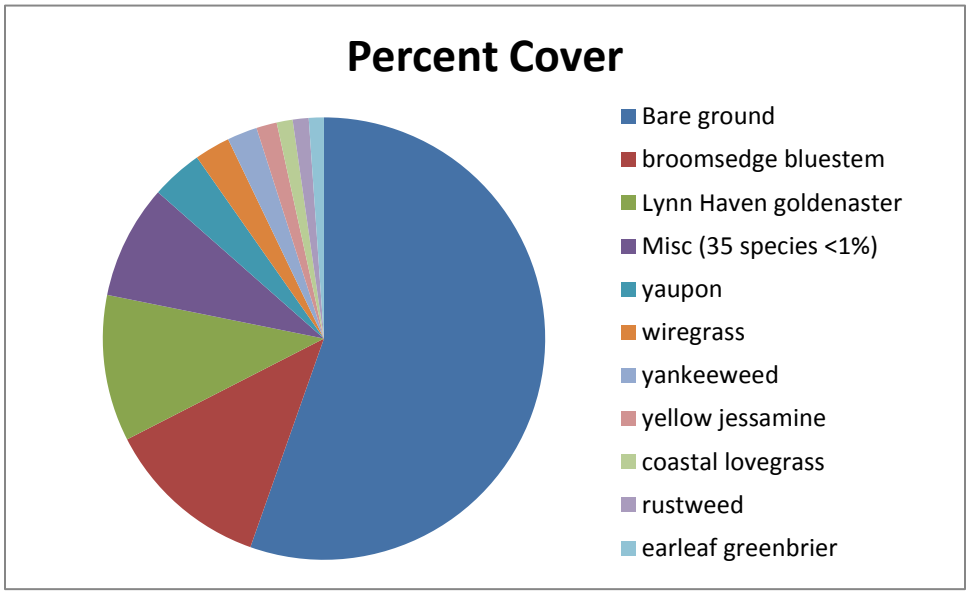

Table PC-2. Percent cover of plant species in Sandhill Transect 1 when sampled on November 4, 2015.

Scientific name	Common name	Average percent cover per quadrat
Andropogon virginicus	broomsedge bluestem	12.07
Chrysopsis lanuginosa	Lynn Haven goldenaster	10.70
Ilex vomitoria	yaupon	3.77
Aristida stricta var. *beyrichiana*	wiregrass	2.60
Eupatorium compositifolium	yankeeweed	2.20
Gelsemium sempervirens	yellow jessamine	1.50
Eragrostis virginica	coastal lovegrass	1.17
Polypremum procumbens	rustweed	1.17
Smilax auriculata	earleaf greenbrier	1.10
Dichanthelium acuminatum	tapered witchgrass	0.83
Hypericum gentianoides	orangegrass	0.80

Scientific name	Common name	Average percent cover per quadrat
Eupatorium capillifolium	dogfennel	0.80
Dichanthelium commutatum	variable witchgrass	0.67
Panicum virgatum	switchgrass	0.50
Galium hispidulum	coastal bedstraw	0.50
Andropogon sp.	bluestem	0.50
Aristida purpurascens	arrowfeather threeawn	0.33
Pseudognaphalium obtusifolium	sweet everlasting	0.27
Houstonia procumbens	roundleaf bluet	0.27
Baptisia lanceolata	gopherweed	0.23
Bulbostylis ciliatifolia	capillary hairsedge	0.23
Pteridium aquilinum	bracken fern	0.23
Rubus cuneifolius	sand blackberry	0.23
Smilax glauca	cat greenbrier	0.23
Solidago odora	sweet goldenrod	0.23
Andropogon glomeratus var. glaucopsis	purple bluestem	0.23
Vernonia angustifolia	tall ironweed	0.23
Scleria ciliata	fringed nutrush	0.10
Smilax laurifolia	laurel greenbrier	0.10
Baccharis halimifolia	groundsel tree	0.10
Eragrostis spectabilis	purple lovegrass	0.10
Liatris pauciflora	fewflower gayfeather	0.10
Vaccinium stamineum	deerberry	0.10
Galactia sp.	milkpea	0.07
Liatris pauciflora var. *secunda*	Piedmont gayfeather	0.03
Gaura sp.	beeblossom	0.03
Solidago stricta	wand goldenrod	0.03
Quercus margarettae	sand post oak	0.03
Liatris gracilis	slender gayfeather	0.03
Dalea pinnata	summer farewell	0.03
Berlandiera pumila	soft greeneyes	0.03
Cnidoscolus stimulosus	tread softly	0.03
Pluchea sp.	camphorweed	0.03
Hieracium sp.	hawkweed	0.03
	Bare ground	55.40

Figure PC-3. Percent species cover in Sandhill Transect 2.

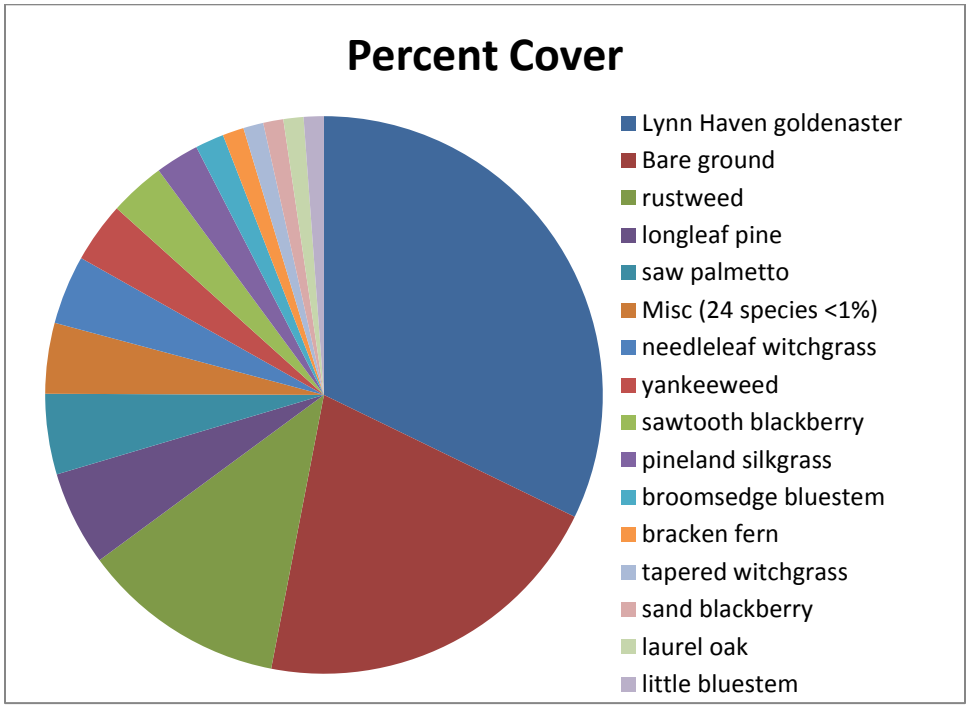

Table PC-3. Percent cover of plant species in Sandhill Transect 2 when sampled on November 5, 2015.

Scientific name	Common name	Average percent cover per quadrat
Chrysopsis lanuginosa	Lynn Haven goldenaster	32.20
Polypremum procumbens	rustweed	11.87
Pinus palustris	longleaf pine	5.50
Serenoa repens	saw palmetto	4.67
Dichanthelium aciculare	needleleaf witchgrass	4.00
Eupatorium compositifolium	yankeeweed	3.50
Rubus pensilvanicus	sawtooth blackberry	3.23
Pityopsis aspera	pineland silkgrass	2.53
Andropogon virginicus	broomsedge bluestem	1.67
Pteridium aquilinum	bracken fern	1.23
Dichanthelium acuminatum	tapered witchgrass	1.17
Rubus cuneifolius	sand blackberry	1.17
Quercus hemisphaerica	laurel oak	1.17
Schizachyrium scoparium	little bluestem	1.17
Gelsemium sempervirens	yellow jessamine	0.83
Solidago odora	sweet goldenrod	0.53
Smilax auriculata	earleaf greenbrier	0.53
Aristida purpurascens	arrowfeather threeawn	0.50

Scientific name	Common name	Average percent cover per quadrat
Cyperus retrorsus	pinebarren flatsedge	0.20
Dichanthelium commutatum	variable witchgrass	0.20
Dichanthelium sp.	witchgrass	0.17
Bulbostylis ciliatifolia	capillary hairsedge	0.10
Cyperus sp.	flatsedge	0.10
Diospyros virginiana	common persimmon	0.10
Andropogon ternarius	splitbeard bluestem	0.10
Pseudognaphalium obtusifolium	sweet everlasting	0.10
Vaccinium arboreum	sparkleberry	0.10
Hypericum hypericoides	St. Andrew's cross	0.10
Houstonia procumbens	roundleaf bluet	0.07
Symphyotrichum dumosum	rice button aster	0.07
Dichanthelium portoricense	hemlock witchgrass	0.07
unknown herb	unknown herb	0.03
Scleria ciliata	fringed nutrush	0.03
Penstemon sp.	beardtongue	0.03
unknown grass	unknown grass	0.03
Euthamia caroliniana	slender flattop goldenrod	0.03
Hypericum gentianoides	orangegrass	0.03
Cladina evansii	a lichen	0.03
	Bare ground	20.83

Mixed Forested Wetland (Restoration)

Qualitative sampling. This mixed forested wetland restoration area (Figure PC-1) resembled a marsh due to its sparse tree cover. The muck soil of the former beaver pond was inundated at the time of the survey. 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 swamp tupelo, sweetbay, and red maple. Shallower areas near the shore were lined with a diverse set of wetland herbs, including taperleaf waterhorehound, and maidencane. The total number of species observed in this community was 30 (Table PC-1).

Quantitative sampling. Transect 1 (Table PC-4, Figure PC-4) had a total of 19 species with 6% bare ground. The highest percent cover was by taperleaf water horehound followed by willow herb, shrubby primrose willow, and sweetbay. The decrease in cover of willow herb relative to the 2012/3 sample was due to its leafless condition at the time of sampling.

Figure PC-4. Percent cover of plant species in Mixed Forested Wetland (Restoration) Transect 1.

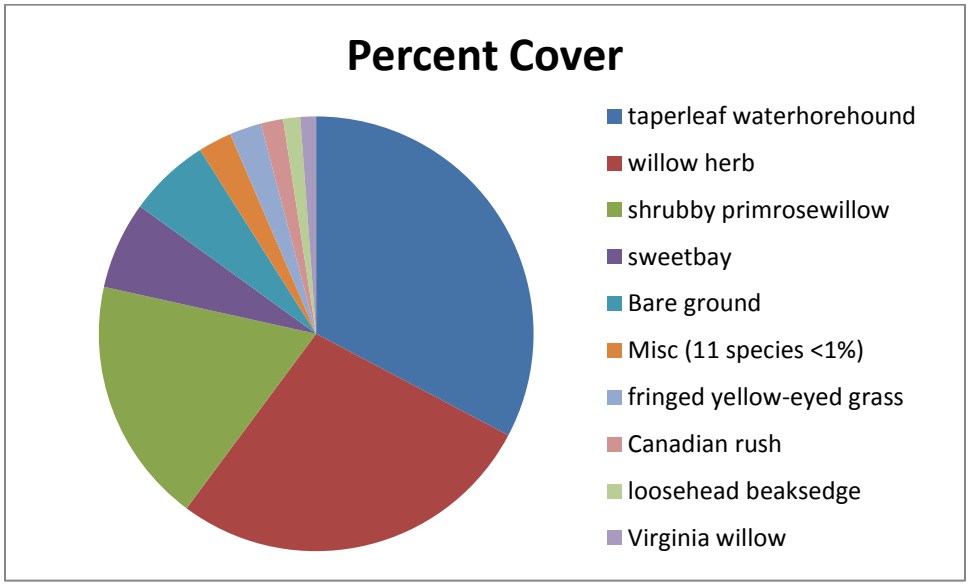

Table PC-4. Percent cover of plant species in Mixed Forested Wetland (Restoration) Transect 1 when sampled on November 4, 2015.

Scientific name	Common name	Average percent cover per quadrat
Lycopus rubellus	taperleaf waterhorehound	32.73
Decodon verticillatus	willow herb	27.43
Ludwigia suffruticosa	shrubby primrosewillow	18.30
Magnolia virginiana	sweetbay	6.50
Xyris fimbriata	fringed yellow-eyed grass	2.37
Juncus canadensis	Canadian rush	1.67
Rhynchospora chalarocephala	loosehead beaksedge	1.27
Itea virginica	Virginia willow	1.17
Rhynchospora nitens	shortbeak beaksedge	0.50
Xyris ambigua	coastalplain yellow-eyed grass	0.50
Bidens mitis	smallfruit beggarticks	0.37
Andropogon virginicus	broomsedge bluestem	0.33
Dulichium arundinaceum	threeway sedge	0.27
Andropogon glomeratus var. *glaucopsis*	purple bluestem	0.23
Nymphoides aquatica	big floatingheart	0.10
Triadenum virginicum	Virginia marsh St. John's wort	0.10
Nymphoides cordata	little floatingheart	0.03
Nyssa sylvatica var. *biflora*	swamp tupelo	0.03
Cephalanthus occidentalis	common buttonbush	0.03
	Bare ground	6.07

Mixed Forested Wetland (Preserved)

Qualitative sampling. The preserved mixed forested wetland (Figure PC-1) was a relatively undisturbed mature baygall forest. The tall canopy of large trees was dominated by sweetbay and swamp tupelo. The dense subcanopy had tree-size black titi, and swamp bay. The moderately dense shrub layer consisted of large gallberry, sweet pepperbush, wild olive, and fetterbush. The sparse herb layer was primarily sphagnum moss. The muck soil was saturated and a few scattered pools of standing water were present. The total number of species observed in this community was 26 (Table PC-1).

Quantitative sampling. Transect 2 (Table PC-5, Figure PC-5) had a total of 13 species with 62% bare ground. (Note: Species cover included ground layer species, tree trunks rooted in the quadrat, and shrubs less than 2 inches dbh. Shading by canopy and subcanopy species was not included.) The dominant shrubs were fetterbush and large gallberry, with lesser amounts of highbush blueberry and sweet pepperbush. Sphagnum moss formed most of the sparse herbaceous cover.

Figure PC-5. Percent cover of plant species in Mixed Forested Wetland (Preserved) Transect 2.

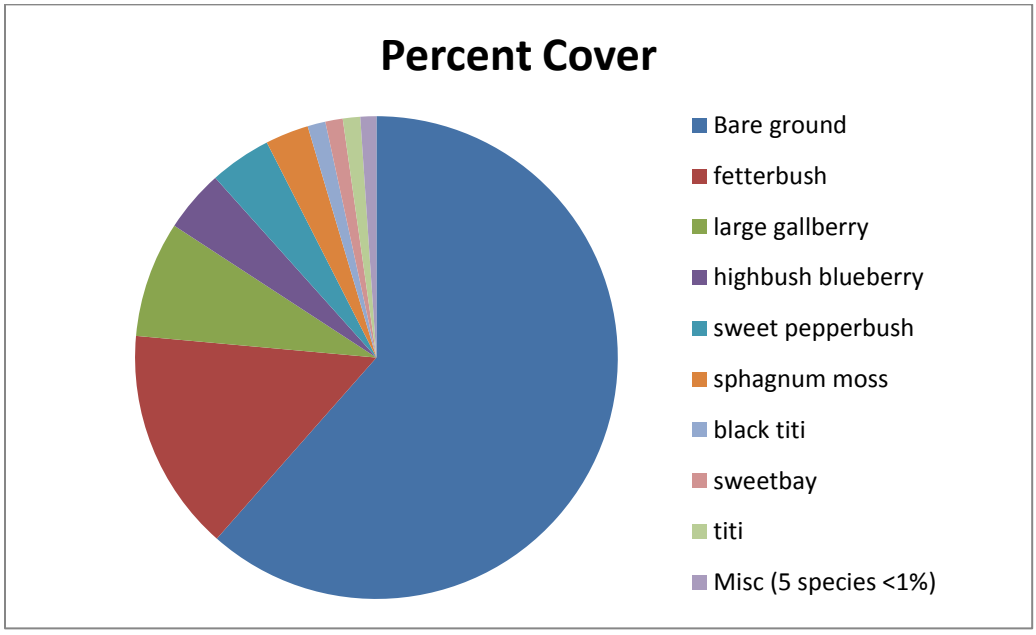

Table PC-5. Percent cover of plant species in Mixed Forested Wetland (Preserved) Transect 2 when sampled on November 4, 2015.

Scientific name	Common name	Average percent cover per quadrat
Lyonia lucida	fetterbush	14.93
Ilex coriacea	large gallberry	7.77
Vaccinium corymbosum	highbush blueberry	4.17
Clethra alnifolia	sweet pepperbush	4.13
Sphagnum sp.	sphagnum moss	2.90
Cliftonia monophylla	black titi	1.20
Magnolia virginiana	sweetbay	1.17
Cyrilla racemiflora	titi	1.17
Carex sp.	sedge	0.50
Vitis rotundifolia	muscadine	0.23
unknown moss	unknown moss	0.13
Apteria aphylla	nodding nixie	0.10
Rhododendron canescens	mountain azalea	0.10
	Bare ground	61.5

Ward Creek West Mitigation Site

Qualitative and Quantitative Monitoring

December 2015

Ward Creek West Mitigation Site
Qualitative and Quantitative Monitoring
December 2015

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 mile west of SR 79 and 2.5 miles north of the junction of SR 79 and US 98. The Ward Creek West Mitigation Project aims to restore hydric pine flatwoods (HPF) and hydric pine savanna (HPS) which had been converted to slash pine plantation, as well as to convert portions of the mixed forested wetlands to cypress (CY; Figure WC-1). Quantitative and qualitative monitoring was used to document the current plant species composition and vegetation structure of these targeted communities. The site vegetation was previously monitored by FNAI biologists in the fall of 2012, 2013, and 2014.

METHODS

The quantitative monitoring utilized 300-foot-long permanent transect lines previously marked during the 2012 survey. In 2013, metal T-posts were placed at each end of the transects to provide permanent reference points. Two transects were located in both the hydric pine flatwoods and hydric pine savanna areas (Figure WC-1). Data recorded consisted of the visually estimated percent cover of each plant species found in fifteen separate 1-meter square quadrats. Tree trunks in quadrats were noted in comments but not recorded as cover; canopy over 2 m in height was also not recorded as cover in quadrats. The quadrats were located to the left side of the transect line 20 feet apart, starting at the 0 point and ending at 280 feet. The qualitative monitoring consisted of recording the species and vegetation structure observed along meandering pedestrian transects through each of the two target communities plus the cypress area. The field surveys were performed by FNAI botanist Ann Johnson on November 10-12, 2015.

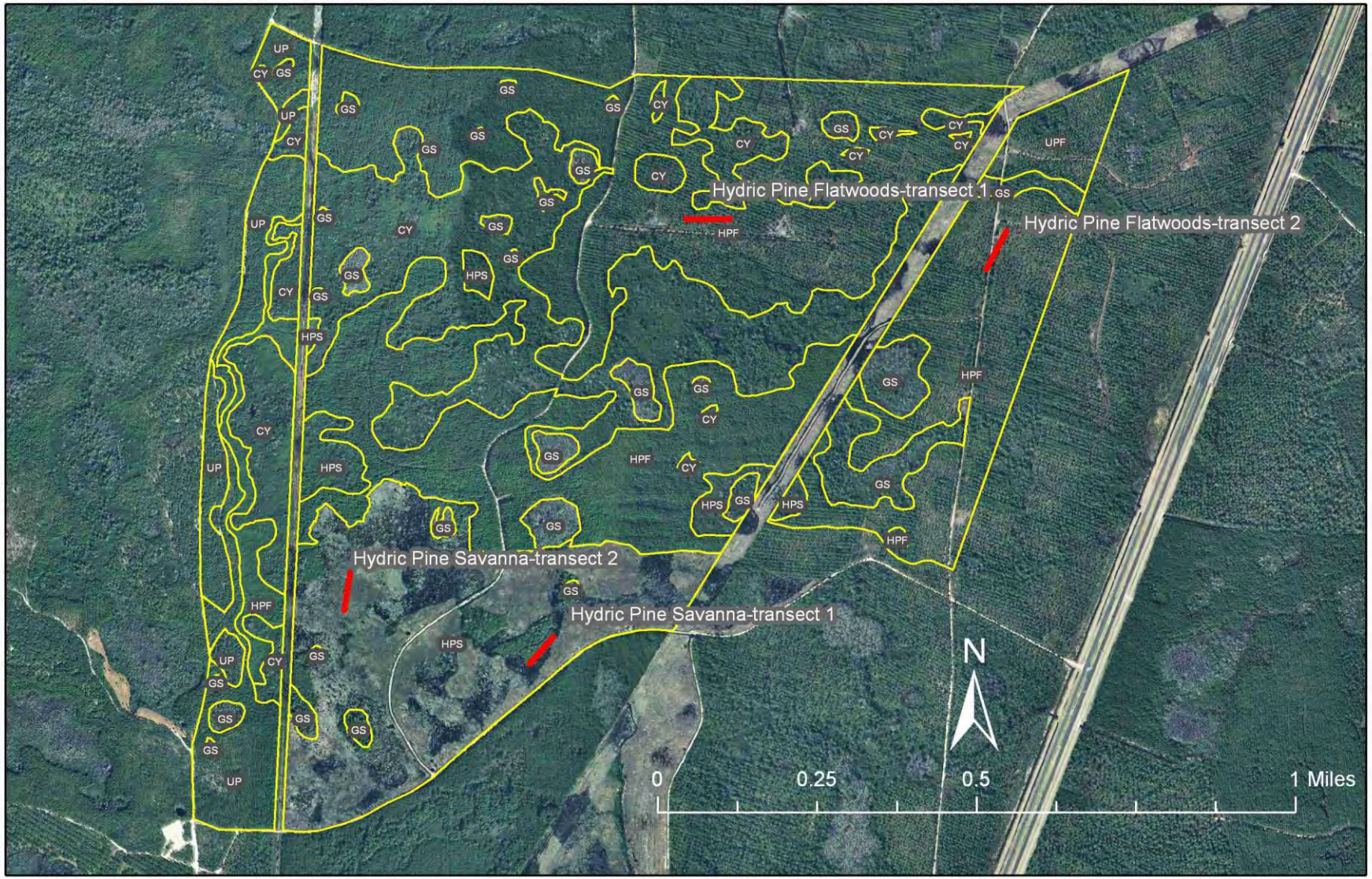

Figure WC-1. Location of permanent transects at Ward Creek West Mitigation Site. CY=Cypress, UP=Upland Pine, HPF=Hydric Pine Flatwoods, HPS=Hydric Pine Savanna, GS=Gum Swamp.

RESULTS AND DISCUSSION

A total of 112 plant species were recorded during 2015 monitoring session in the target communities at Ward Creek West (Table WC-1).

Hydric Pine Flatwoods

Qualitative sampling. The hydric pine flatwoods areas had been disturbed in the past few years by the silviculture action of thinning of the mature planted slash pines. The soil was currently moist to dry, but old machinery ruts were evident. The open canopy of mature slash pines covered a variously dense shrub layer. The area near the western Transect 1 had been bedded years ago when the pines were planted. This area had a moderately dense shrub stratum and an herbaceous layer of composed primarily of purple bluestem. The eastern section had more saw palmetto and gallberry and a diverse herbaceous cover with scattered wiregrass and beaksedges. The total number of species observed in this community was 67 (Table WC-1).

Quantitative sampling. The western Transect 1 (Table WC-2, Figure WC-2) had a total of 16 species with 59% bare ground. Woody species contributed the most cover (large gallberry and black titi, and slash pine seedlings), followed by purple bluestem. The eastern Transect 2 (Table WC-3, Figure WC-3) had a total of 32 species with 34% bare ground. The vegetation was more diverse than in Transect 1. Shrubby species contributed most of the cover, primarily gallberry and dwarf live oak, with the rest of the shrub cover fairly evenly divided between coastalplain St John's wort, saw palmetto, large gallberry, and black titi. Witchgrass species and purple bluestem made up most of the sparse herbaceous cover.

Table WC-1. Plant species observed in the target communities at Ward Creek West Mitigation Site, November 10, 11, and 12, 2015.

Scientific Name	Common Name	cypress	hydric pine flatwoods	hydric pine savanna	Grand Total
Acer rubrum	red maple	X			1
Andropogon glomeratus	bushy bluestem		X	X	2
Andropogon glomeratus var. glaucopsis	purple bluestem		X	X	2
Andropogon sp.	bluestem		X		1
Andropogon virginicus	broomsedge bluestem		X	X	2
Andropogon virginicus var. glaucus	chalky bluestem	X		X	2
Aristida spiciformis	bottlebrush threeawn		X		1
Aristida stricta var. beyrichiana	wiregrass		X	X	2
Balduina angustifolia	coastalplain honeycomb-head		X		1
Bidens mitis	smallfruit beggarticks		X		1
Calamovilfa curtissii	Curtiss' sandgrass			X	1
Carex striata	Walter's sedge			X	1
Carphephorus odoratissimus	vanillaleaf		X		1

Scientific Name	Common Name	cypress	hydric pine flatwoods	hydric pine savanna	Grand Total
Centella asiatica	spadeleaf	X			1
Chrysopsis lanuginosa	Lynn Haven goldenaster		X		1
Clethra alnifolia	sweet pepperbush	X	X		2
Cliftonia monophylla	black titi	X	X	X	3
Ctenium aromaticum	toothache grass			X	1
Cyrilla racemiflora	titi	X	X	X	3
Dichanthelium commutatum	variable witchgrass		X		1
Dichanthelium erectifolium	erectleaf witchgrass			X	1
Dichanthelium portoricense	hemlock witchgrass		X		1
Dichanthelium sp.	witchgrass		X	X	2
Diodia virginiana	Virginia buttonweed		X		1
Drosera capillaris	pink sundew			X	1
Eriocaulon decangulare	tenangle pipewort	X		X	2
Eupatorium leucolepis	justiceweed			X	1
Eupatorium linearifolium	waxy thoroughwort			X	1
Eupatorium sp.	thoroughwort		X	X	2
Euthamia caroliniana	slender flattop goldenrod		X	X	2
Fuirena pumila	dwarf umbrellasedge			X	1
Gaylussacia frondosa var. tomentosa	blue huckleberry		X		1
Gelsemium sempervirens	yellow jessamine		X		1
Helianthus angustifolius	narrowleaf sunflower			X	1
Houstonia procumbens	roundleaf bluet		X		1
Hypericum brachyphyllum	coastalplain St. John's wort		X	X	2
Hypericum fasciculatum	peelbark St. John's wort			X	1
Hypericum microsepalum	flatwoods St. John's wort		X		1
Hypericum tetrapetalum	fourpetal St. John's wort		X	X	2
Ilex cassine var. myrtifolia	myrtle-leaved holly	X			1
Ilex coriacea	large gallberry	X	X	X	3
Ilex glabra	gallberry	X	X	X	3
Ilex vomitoria	yaupon		X	X	2
Juncus scirpoides	needlepod rush		X		1
Kalmia hirsuta	hairy wicky		X	X	2
Lachnanthes caroliana	Carolina redroot		X	X	2
Lachnocaulon anceps	whitehead bogbutton		X		1
Liatris spicata	dense gayfeather			X	1
Lobelia brevifolia	shortleaf lobelia			X	1
Lophiola aurea	golden crest			X	1

Scientific Name	Common Name	cypress	hydric pine flatwoods	hydric pine savanna	Grand Total
Lycopodiella alopecuroides	foxtail club-moss			X	1
Lyonia ferruginea	rusty staggerbush		X		1
Lyonia fruticosa	coastalplain staggerbush			X	1
Lyonia ligustrina var. foliosiflora	maleberry		X		1
Lyonia lucida	fetterbush	X	X	X	3
Magnolia virginiana	sweetbay	X	X	X	3
Myrica caroliniensis	evergreen bayberry	X			1
Nyssa ogeche	ogeechee tupelo	X			1
Nyssa sylvatica var. *biflora*	swamp tupelo	X			1
Nyssa ursina	bog tupelo		X	X	2
Onoclea sensibilis	sensitive fern		X		1
Osmunda cinnamomea	cinnamon fern	X			1
Panicum longifolium	panicum	X			1
Panicum verrucosum	warty panicgrass		X	X	2
Panicum virgatum	switchgrass			X	1
Persea palustris	swamp bay	X			1
Photinia pyrifolia	red chokeberry		X		1
Pinus elliottii	slash pine	X	X	X	3
Pinus palustris	longleaf pine	X			1
Pluchea sp.	camphorweed			X	1
Polygala cruciata	drumheads			X	1
Polygala lutea	orange milkwort		X		1
Polygonella gracilis	tall jointweed		X		1
Pteridium aquilinum	bracken fern			X	1
Quercus minima	dwarf live oak		X		1
Rhexia petiolata	fringed meadowbeauty		X	X	2
Rhexia virginica	handsome harry		X		1
Rhus copallinum	winged sumac		X		1
Rhynchospora cephalantha	bunched beaksedge	X		X	2
Rhynchospora chalarocephala	loosehead beaksedge			X	1
Rhynchospora chapmanii	Chapman's beaksedge		X	X	2
Rhynchospora compressa	flatfruit beaksedge		X	X	2
Rhynchospora corniculata	shortbristle horned beaksedge			X	1
Rhynchospora fascicularis	fascicled beaksedge		X		1
Rhynchospora plumosa	plumed beaksedge		X	X	2
Rhynchospora sp.	beaksedge		X	X	2
Rubus pensilvanicus	sawtooth blackberry		X		1

Scientific Name	Common Name	cypress	hydric pine flatwoods	hydric pine savanna	Grand Total
Sabatia brevifolia	shortleaf rosegentian		X	X	2
Saccharum giganteum	sugarcane plumegrass			X	1
Sarracenia rubra	sweet pitcherplant			X	1
Scleria ciliata	fringed nutrush		X		1
Scleria reticularis	netted nutrush			X	1
Serenoa repens	saw palmetto		X		1
Smilax auriculata	earleaf greenbrier		X		1
Smilax laurifolia	laurel greenbrier	X	X	X	3
Solidago fistulosa	pinebarren goldenrod		X	X	2
Solidago odora	sweet goldenrod		X		1
Sphagnum sp.	sphagnum moss	X			1
Syngonanthus flavidulus	yellow hatpins		X	X	2
Taxodium ascendens	pond cypress	X			1
unknown graminoid	unknown graminoid			X	1
unknown moss	unknown moss			X	1
Vaccinium corymbosum	highbush blueberry		X		1
Vaccinium myrsinites	shiny blueberry		X		1
Vitis rotundifolia	muscadine	X	X		2
Woodwardia virginica	Virginia chain fern		X		1
Xyris ambigua	coastalplain yellow-eyed grass			X	1
Xyris caroliniana	Carolina yellow-eyed grass		X		1
Xyris drummondii	Drummond's yellow-eyed grass			X	1
Xyris elliottii	Elliott's yellow-eyed grass			X	1
Xyris sp.	yellow-eyed grass		X		1
Xyris stricta	pineland yellow-eyed grass			X	1
Total number of species: 112		25	67	63	155

Figure WC-2. Percent cover of plant species in Hydric Pine Flatwoods Transect 1.

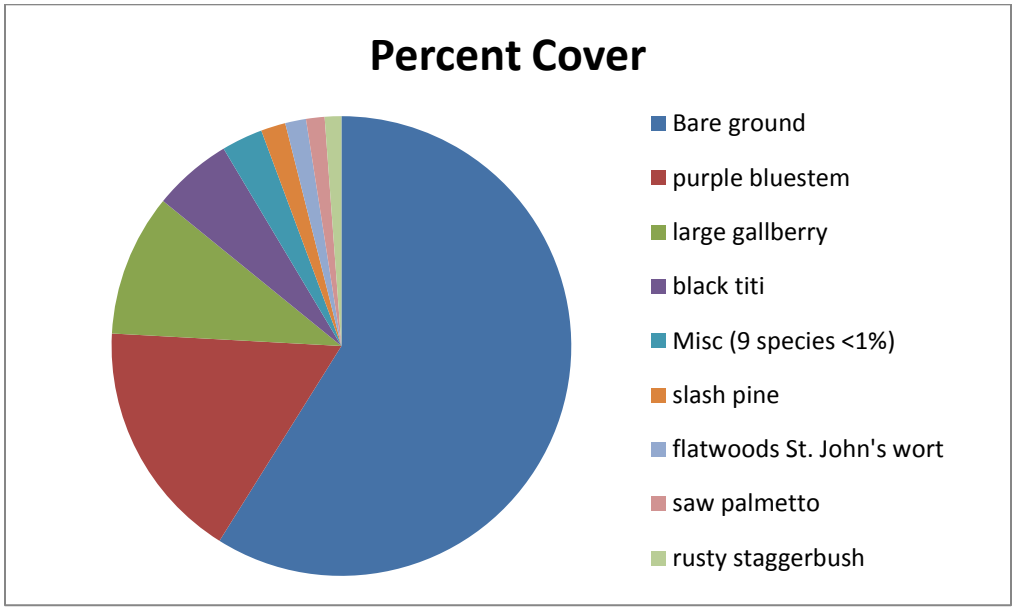

Table WC-2. Percent cover of plant species in Hydric Pine Flatwoods Transect 1 when sampled on November 11, 2015.

Scientific name	Common name	Average percent cover per quadrat
Andropogon glomeratus var. *glaucopsis*	purple bluestem	16.97
Ilex coriacea	large gallberry	10.00
Cliftonia monophylla	black titi	5.57
Pinus elliottii (seedlings)	slash pine	1.73
Hypericum microsepalum	flatwoods St. John's wort	1.47
Serenoa repens	saw palmetto	1.30
Lyonia ferruginea	rusty staggerbush	1.17
Smilax laurifolia	laurel greenbrier	0.87
Clethra alnifolia	sweet pepperbush	0.60
Rhynchospora fascicularis	fascicled beaksedge	0.43
Vitis rotundifolia	muscadine	0.43
Rubus pensilvanicus	sawtooth blackberry	0.23
Vaccinium corymbosum	highbush blueberry	0.23
Dichanthelium sp.	witchgrass	0.03
Rhexia petiolata	fringed meadowbeauty	0.03
Rhynchospora chapmanii	Chapman's beaksedge	0.03
	Bare ground	58.90

Figure WC-3. Percent cover of plant species in Hydric Pine Flatwoods Transect 2.

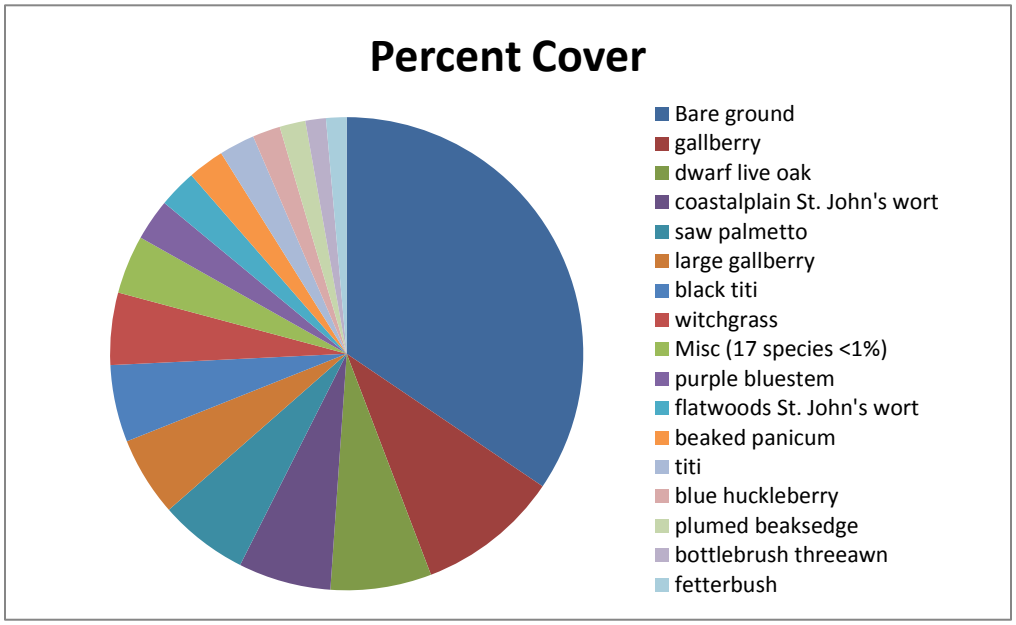

Table WC-3. Percent cover of plant species in Hydric Pine Flatwoods Transect 2 when sampled on November 11, 2015.

Scientific name	Common name	Average percent cover per quadrat
Ilex glabra	gallberry	9.73
Quercus minima	dwarf live oak	6.90
Hypericum brachyphyllum	coastalplain St. John's wort	6.33
Serenoa repens	saw palmetto	6.10
Ilex coriacea	large gallberry	5.43
Cliftonia monophylla	black titi	5.27
Dichanthelium sp.	witchgrass	4.93
Andropogon glomeratus var. *glaucopsis*	purple bluestem	2.83
Hypericum microsepalum	flatwoods St. John's wort	2.60
Panicum anceps	beaked panicum	2.50
Cyrilla racemiflora	titi	2.43
Gaylussacia frondosa var. *tomentosa*	blue huckleberry	1.90
Rhynchospora plumosa	plumed beaksedge	1.77
Aristida spiciformis	bottlebrush threeawn	1.40
Lyonia lucida	fetterbush	1.40
Pinus elliottii	slash pine	0.83
Rhynchospora fascicularis	fascicled beaksedge	0.50
Syngonanthus flavidulus	yellow hatpins	0.50
Vaccinium myrsinites	shiny blueberry	0.47
Andropogon sp.	bluestem	0.23

Scientific name	Common name	Average percent cover per quadrat
Photinia pyrifolia	red chokeberry	0.23
Rhexia virginica	handsome harry	0.23
Smilax auriculata	earleaf greenbrier	0.20
Lachnocaulon anceps	whitehead bogbutton	0.13
Rhynchospora sp.	beaksedge	0.13
Dichanthelium commutatum	variable witchgrass	0.10
Dichanthelium portoricense	hemlock witchgrass	0.10
Lyonia ligustrina var. *foliosiflora*	maleberry	0.10
Xyris sp.	yellow-eyed grass	0.10
Houstonia procumbens	roundleaf bluet	0.07
Carphephorus odoratissimus	vanillaleaf	0.03
Panicum verrucosum	warty panicgrass	0.03
	Bare ground	34.47

Hydric Pine Savanna

Qualitative sampling. The hydric pine savanna restoration area was highly disturbed by silviculture operations. The pines have been harvested and the vegetative cover currently consists of a dense, tall stand of purple bluestem with scattered clumps of wiregrass intermixed. Widely scattered young slash pine and pond cypress and shrub clumps of fetterbush, titi and black titi occur throughout. The soil was dry except in a few lower pockets with standing water. Two large clumps of Curtiss' sandgrass (*Calamovilfa curtissii*), listed as threatened by the state, were found in this community. The total number of plant species observed in this community was 63 (Table WC-1).

Quantitative sampling. Transect 1 (Table WC-4, Figure WC-4) had a total of 24 species and 38% bare ground. Groundcover was heavily dominated by purple bluestem, with lesser amounts of Elliott's yelloweyed grass. The sparse shrub layer was mostly composed of peelbark St. John's wort and fetterbush. Transect 2 (Table WC-5, Figure WC-5) had a total of 27 species and 35% bare ground. The vegetation was also dominated by purple bluestem plus a small amount of wiregrass. Black titi was the most common species in the sparse shrub layer, followed by fetterbush, and peelbark St. Johns wort.

Figure WC-4. Percent cover of plant species in Hydric Pine Savanna Transect 1.

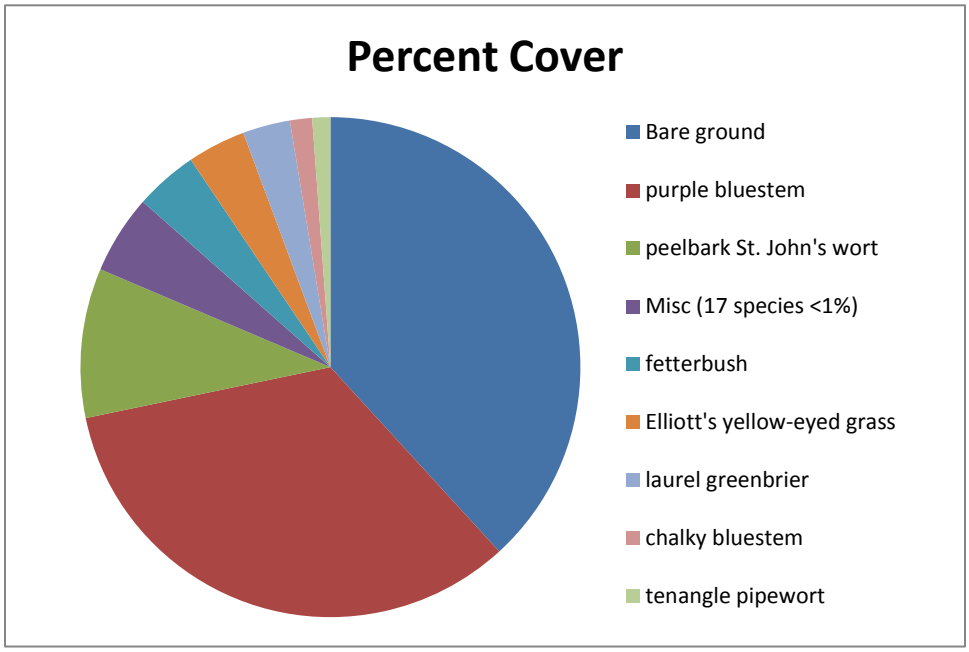

Table WC-4. Percent cover of species in Hydric Pine Savanna Transect 1 when sampled on November 10, 2015.

Scientific name	Common name	Average percent cover per quadrat
Andropogon glomeratus var. *glaucopsis*	purple bluestem	33.53
Hypericum fasciculatum	peelbark St. John's wort	9.67
Lyonia lucida	fetterbush	4.07
Xyris elliottii	Elliott's yellow-eyed grass	3.77
Smilax laurifolia	laurel greenbrier	3.07
Andropogon virginicus var. *glaucus*	chalky bluestem	1.43
Eriocaulon decangulare	tenangle pipewort	1.17
Lachnanthes caroliana	Carolina redroot	0.73
Cyrilla racemiflora	titi	0.57
Andropogon virginicus	broomsedge bluestem	0.50
Rhynchospora sp.	beaksedge	0.50
Pinus elliottii	slash pine	0.43
Ilex coriacea	large gallberry	0.33
Rhynchospora chapmanii	Chapman's beaksedge	0.33
Cliftonia monophylla	black titi	0.23
Euthamia caroliniana	slender flattop goldenrod	0.23
Hypericum brachyphyllum	coastalplain St. John's wort	0.23
Sarracenia rubra	sweet pitcherplant	0.23
unknown graminoid	unknown graminoid	0.20
Rhexia petiolata	fringed meadowbeauty	0.13
Scleria reticularis	netted nutrush	0.13

Scientific name	Common name	Average percent cover per quadrat
Rhynchospora chalarocephala	loosehead beaksedge	0.10
Xyris ambigua	coastalplain yellow-eyed grass	0.10
Xyris stricta	pineland yellow-eyed grass	0.10
	Bare ground	38.20

Figure WC-5. Percent cover of plant species in Hydric Pine Savanna Transect 2.

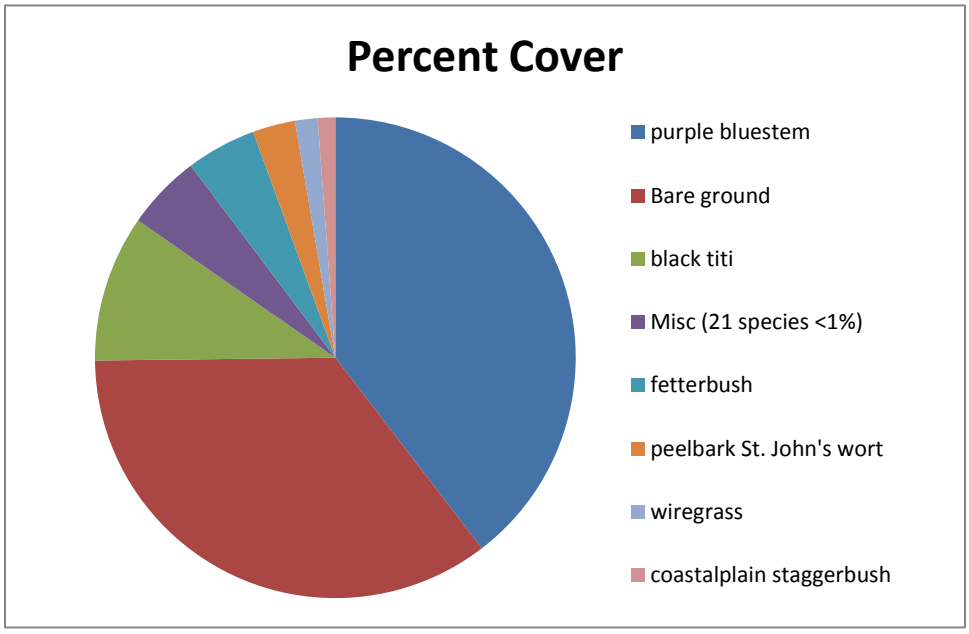

Table WC-5. Percent cover of plant species in Hydric Pine Savanna Transect 2 when sampled on November 11, 2015.

Scientific name	Common name	Average percent cover per quadrat
Andropogon glomeratus var. *glaucopsis*	purple bluestem	39.17
Cliftonia monophylla	black titi	9.77
Lyonia lucida	fetterbush	4.67
Hypericum fasciculatum	peelbark St. John's wort	2.83
Aristida stricta var. *beyrichiana*	wiregrass	1.50
Lyonia fruticosa	coastalplain staggerbush	1.17
Andropogon virginicus	broomsedge bluestem	0.83
Eriocaulon decangulare	tenangle pipewort	0.73
Hypericum brachyphyllum	coastalplain St. John's wort	0.73
Cyrilla racemiflora	titi	0.47
Pinus elliottii	slash pine	0.33
Rhexia petiolata	fringed meadowbeauty	0.27
Xyris ambigua	coastalplain yellow-eyed grass	0.27

Scientific name	Common name	Average percent cover per quadrat
Ilex vomitoria	yaupon	0.23
Smilax laurifolia	laurel greenbrier	0.23
Ctenium aromaticum	toothache grass	0.10
Kalmia hirsuta	hairy wicky	0.10
Lachnanthes caroliana	Carolina redroot	0.10
Pluchea sp.	camphorweed	0.10
Rhynchospora cephalantha	bunched beaksedge	0.10
Rhynchospora chalarocephala	loosehead beaksedge	0.10
Rhynchospora plumosa	plumed beaksedge	0.10
Lycopodiella alopecuroides	foxtail club-moss	0.07
Eupatorium sp.	thoroughwort	0.03
Euthamia caroliniana	slender flattop goldenrod	0.03
Pteridium aquilinum	bracken fern	0.03
unknown moss	unknown moss	0.03
	Bare ground	34.90

Cypress

Qualitative sampling. The cypress areas occurred along water drainage channels with a dense evergreen canopy on the edges composed of black titi, swamp bay, longleaf and slash pine, and sweetbay, with deciduous species such as Ogeechee tupelo, swamp tupelo, and pond cypress in the center. The shrub layer often consisted of dense stands of black titi and large gallberry on the edges and very sparse stands in the center, composed of fetterbush, and sweet pepperbush. Herbs were very infrequent. At the time of sampling, the the ground was moist to inundated. Total number of species observed in this community was 25 (Table WC-1).