Vegetation Monitoring at Perdido River Northwest Florida Water Management District Mitigation Site

Fall 2023

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Florida State University

Perdido River Water Management Area – Phase II Mitigation Site
Qualitative and Quantitative Monitoring
November 2023

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 1). The mitigation project aims to restore areas of Wetland Forest Mixed (MFW), Hydric Savanna (HS), Hydric Pine Flatwoods (HPF) and Pine Flatwoods (PF; Figure 2). The HPF and PF were converted to loblolly pine plantation in 2002. 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 every fall from 2012 to 2022.

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 set up in each targeted natural community type: Hydric Savanna, Wetland Forest Mixed, and Hydric Pine Flatwoods (Figure 2). Along each transect line, eight 1m x 1m quadrats were placed along the left side, beginning at 0 and then spaced every 20 feet. Data recorded in each quadrat consisted of the visually estimated percent cover of each plant species, including individuals rooted in the quadrat as well as overhanging. Canopy over 2 m in height was excluded from cover estimates. Only the lower 2 m portions of larger individuals were counted as cover, including the lower portions of tree trunks rooted in quadrats. Bare ground was estimated in each quadrat as a percentage of ground not obscured by plant cover or large woody debris. Plant cover estimates were converted to mid-point values and averaged across each transect. Relative cover (in which all plant cover and bare ground is given as a proportion of 100 percent cover) was also calculated and is reported in separate pie charts.

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. Field surveys were performed by FNAI botanists Kim Alexander, Allie Heiker, and Ethan Hughes on November 28, 2023.

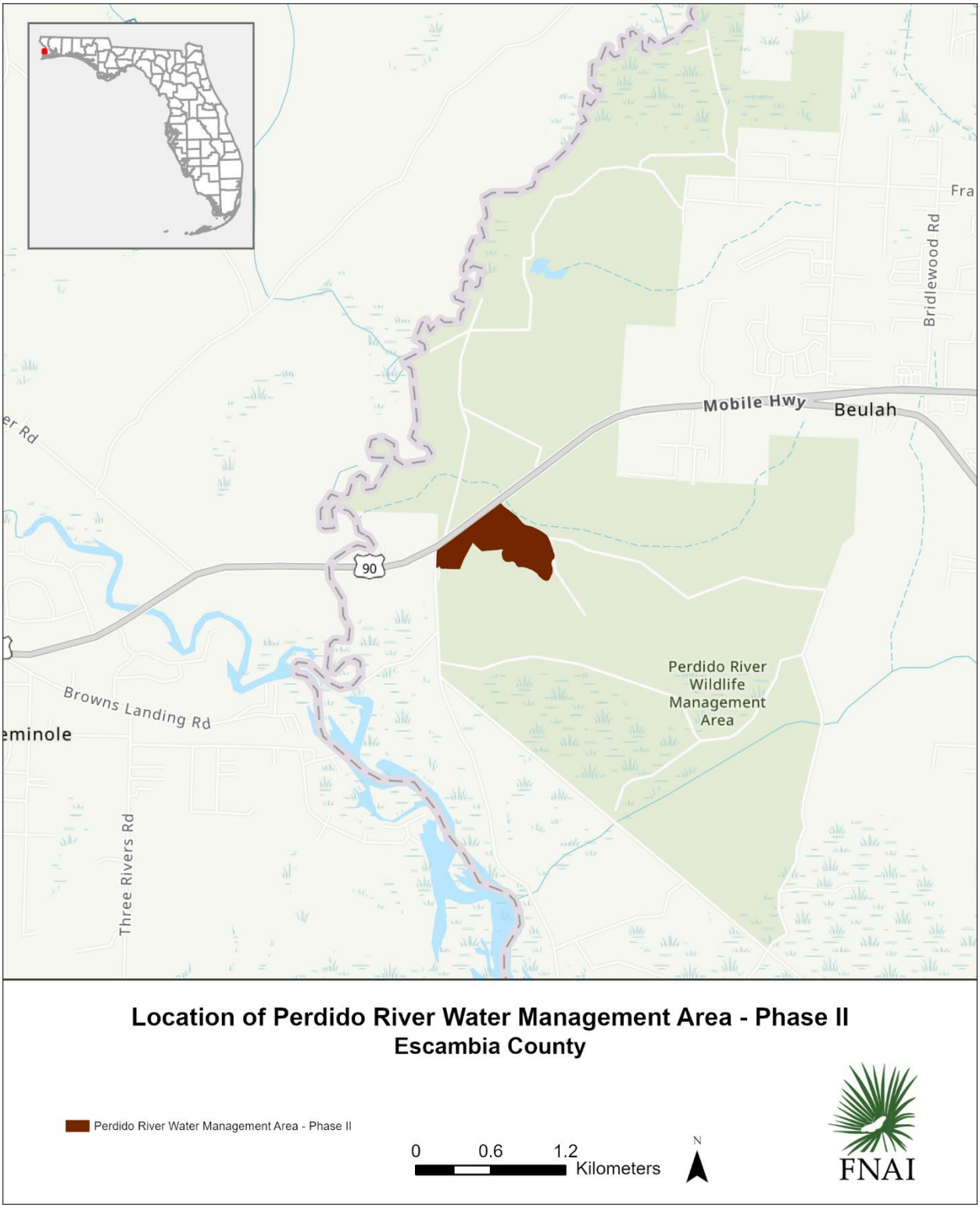

Figure 1. Location map of Perdido River Water Management Area – Phase II Mitigation Site monitored by FNAI.

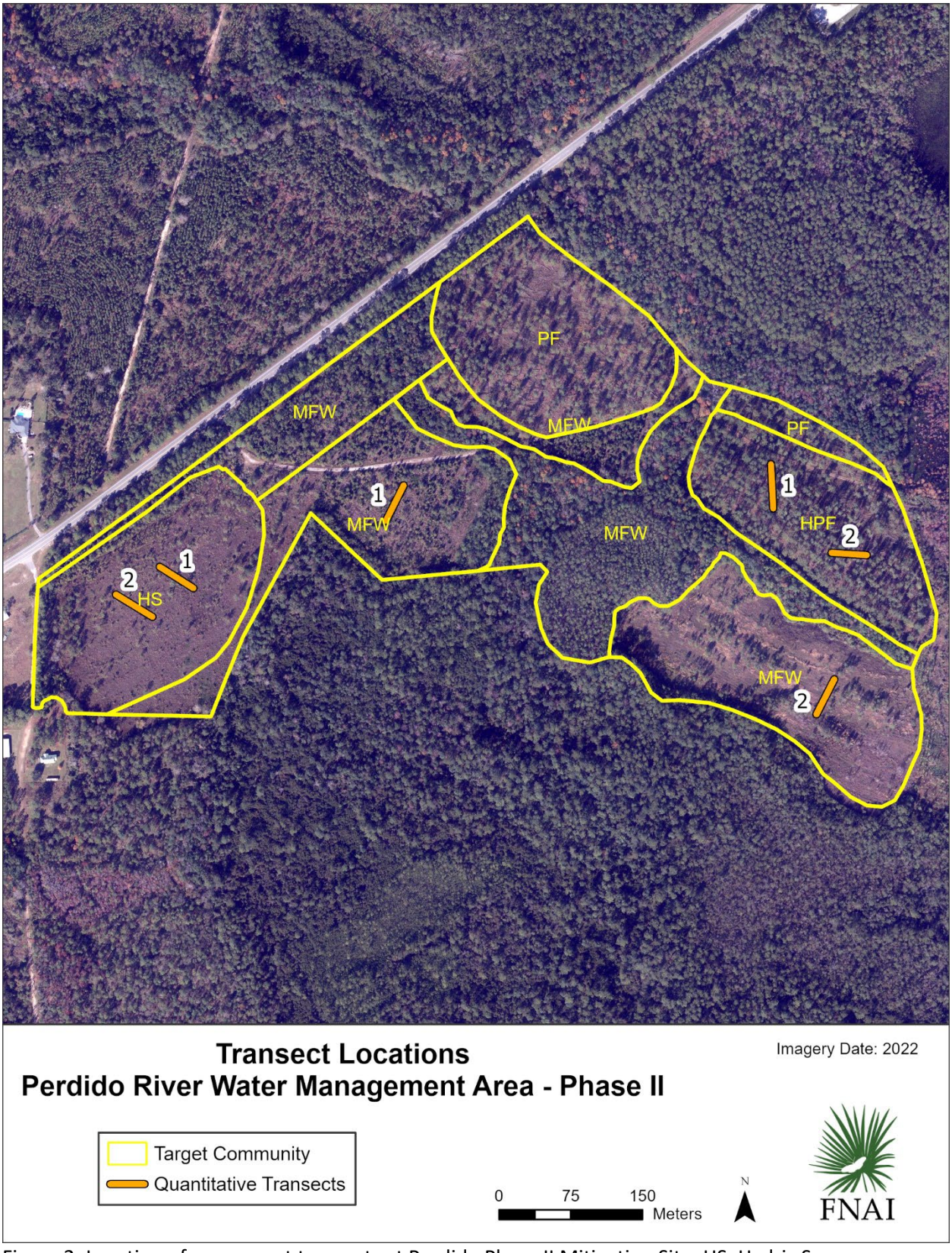

Figure 2. Location of permanent transects at Perdido Phase II Mitigation Site. HS=Hydric Savanna, HPF=Hydric Pine Flatwoods, MFW= Forested Wetland Mixed, PF=Pine Flatwoods.

RESULTS AND DISCUSSION

A total of 182 plant taxa were observed during the 2023 monitoring of the target communities at Perdido River Phase II (Table 1). Fifteen new taxa were noted, i.e. species or varieties not observed in any previous survey. Taxonomy follows Wunderlin, R. P., B.F. Hansen, A.R. Franck, and F.B. Essig. 2017. Atlas of Florida Plants (htpp://florida.plantatlas.usf.edu/), Institute for Systematic Botany, University of South Florida, Tampa.

Table 1. Species observed in target communities at Perdido River WMA – Phase II Mitigation Site on November 28, 2023. (bold name = new species; bold X = new observation in community type; * = state-listed endangered or threatened; † = non-native invasive)

Scientific Name	Common Name	Hydric Pine Flatwoods	Hydric Savanna	Pine Flatwoods	Wetland Forest Mixed	Grand Total
Acer rubrum	red maple	X	X	X	X	4
Ageratina aromatica	lesser snakeroot	**X**				1
Aletris lutea	yellow colic-root				X	1
Andropogon glomeratus	bushy bluestem	X				1
Andropogon glomeratus var. *glaucopsis*	purple bluestem	X	X	X	X	4
Andropogon virginicus	broomsedge bluestem	X	X		X	3
Anthaenantia rufa	purple silkyscale	X				1
Aristida purpurascens var. *virgata*	arrowfeather threeawn	X		X	X	3
Aristida spiciformis	bottlebrush threeawn				X	1
Aristida stricta	wiregrass	X		X		2
Aronia arbutifolia	red chokeberry	X	X		X	3
Arundinaria gigantea	switchcane			X	X	2
Axonopus fissifolius	common carpetgrass				**X**	1
***Axonopus* sp.**	carpetgrass			**X**		1
Baccharis halimifolia	groundsel tree		X			1
Bidens mitis	smallfruit beggarticks	X	X	X	X	4
**Calamovilfa curtissii*	Curtiss' sandgrass	X				1
Carex elliottii	Elliott's sedge				**X**	1
Carex glaucescens	clustered sedge	X	X	X	X	4
Carex lonchocarpa	southern longsedge				**X**	1
Carex longii	Long's sedge	X				1
Carex sp.	sedge	X		X	**X**	3
Carphephorus odoratissimus	vanillaleaf				X	1
Castanea pumila	chinquapin			X		1
Centella asiatica	spadeleaf	X	X		X	3
Chamaecyparis thyoides	Atlantic white cedar		X	X	X	3
Chasmanthium ornithorhynchum	birdbill woodoats	**X**			**X**	2
Clethra alnifolia	sweet pepperbush	X			X	2
Cliftonia monophylla	black titi			X	X	2
Coleataenia anceps	beaked panicum	X		X		2

Scientific Name	Common Name	Hydric Pine Flatwoods	Hydric Savanna	Pine Flatwoods	Wetland Forest Mixed	Grand Total
Coleataenia longifolia	ciliate redtop panicum	X			X	2
Ctenium aromaticum	toothache grass	X			**X**	2
Cyrilla racemiflora	titi	X			X	2
Dichanthelium ensifolium	cypress witchgrass	X		X	X	3
Dichanthelium ensifolium var. *unciphyllum*	cypress witchgrass			X	X	2
Dichanthelium laxiflorum	openflower witchgrass			X		1
Dichanthelium leucothrix	rough witchgrass				X	1
Dichanthelium portoricense	hemlock witchgrass				X	1
Dichanthelium scabriusculum	woolly witchgrass	X		X	X	3
Dichanthelium sphaerocarpon	roundseed witchgrass				**X**	1
Dichanthelium strigosum	roughhair witchgrass				X	1
Drosera brevifolia	dwarf sundew				X	1
Drosera capillaris	pink sundew				X	1
Eleocharis tuberculosa	conecup spikerush			X	X	2
Eleocharis vivipara	viviparous spikerush		X			1
Elephantopus carolinianus	Carolina elephantsfoot	X		X		2
Elephantopus elatus	tall elephantsfoot	X				1
Elephantopus nudatus	smooth elephantsfoot	X		X		2
Eragrostis elliottii	Elliott's lovegrass				X	1
Eragrostis sp.	lovegrass			**X**		1
Eriocaulon compressum	flattened pipewort				X	1
Eriocaulon decangulare	tenangle pipewort	X			X	2
Eupatorium capillifolium	dogfennel	X		X		2
Eupatorium mohrii	Mohr's thoroughwort	X	X		X	3
Eupatorium pilosum	rough boneset	X	X	X	X	4
Eupatorium rotundifolium	roundleaf thoroughwort			X	X	2
Eupatorium semiserratum	smallflower thoroughwort	X		X		2
Eupatorium x anomalum	Florida thoroughwort	**X**	**X**	**X**		3
Euthamia caroliniana	slender flattop goldenrod	X	X	X	X	4
Euthamia graminifolia	flattop goldenrod	X				1
Gaylussacia dumosa	dwarf huckleberry				X	1
Gaylussacia mosieri	woolly huckleberry	X	X	X	X	4
Helianthus angustifolius	narrowleaf sunflower	X				1
Hydrocotyle umbellata	manyflower marshpennywort		X			1
Hypericum brachyphyllum	coastalplain St. John's wort	X	X		X	3
Hypericum cistifolium	roundpod St. John's wort				X	1
Hypericum crux-andreae	St. Peter's wort	X	X	X	X	4
Hypericum fasciculatum	peelbark St. John's wort	**X**				1
Hypericum hypericoides	St. Andrew's cross	X		X	**X**	3
Hyptis alata	clustered bushmint	X	X	X	**X**	4
Ilex cassine	dahoon				X	1
Ilex cassine var. *myrtifolia*	myrtle-leaved holly	X			X	2
Ilex coriacea	large gallberry	X	X	X	X	4

Scientific Name	Common Name	Hydric Pine Flatwoods	Hydric Savanna	Pine Flatwoods	Wetland Forest Mixed	Grand Total
Ilex glabra	gallberry	X	X	X	X	4
Ilex vomitoria	yaupon	X		X	X	3
Itea virginica	Virginia willow				**X**	1
Juncus marginatus	grassleaf rush	X	**X**	X	X	4
Kalmia hirsuta	hairy wicky				X	1
Kellochloa verrucosa	warty panicgrass	X	X	X	X	4
Lachnanthes caroliana	Carolina redroot		X			1
Lachnocaulon anceps	whitehead bogbutton	X		X	X	3
Lobelia brevifolia	shortleaf lobelia	X			X	2
Ludwigia linearis	narrowleaf primrosewillow	**X**		X	X	3
Ludwigia maritima	seaside primrosewillow	X				1
Ludwigia pilosa	hairy primrosewillow	X	X	X	X	4
Ludwigia virgata	savannah primrosewillow			**X**		1
Lycopodiella alopecuroides	foxtail club-moss	X	X	X	X	4
Lycopodiella appressa	southern club-moss				X	1
Lycopodiella caroliniana	slender club-moss				**X**	1
Lycopus amplectens	clasping waterhorehound			**X**		1
Lycopus rubellus	taperleaf waterhorehound		X			1
†*Lygodium japonicum*	Japanese climbing fern	X				1
Lyonia lucida	fetterbush	X			X	2
Magnolia grandiflora	southern magnolia		**X**			1
Magnolia virginiana	sweetbay	X	X	X	X	4
Mitchella repens	partridgeberry				**X**	1
Morella caroliniensis	evergreen bayberry			X	X	2
Morella cerifera	southern bayberry	X	X	X	X	4
Morella inodora	odorless bayberry				**X**	1
Muhlenbergia capillaris var. *trichopodes*	cutover muhly	X				1
Nyssa biflora	swamp tupelo		X		**X**	2
Oldenlandia uniflora	clustered mille graines	X			X	2
Osmunda cinnamomea	cinnamon fern	X		X	X	3
Osmunda regalis var. *spectabilis*	royal fern	X				1
Paspalum urvillei	vaseygrass	**X**				1
Peltandra sagittifolia	spoon-flower				**X**	1
Persea palustris	swamp bay	X	X	X	X	4
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
Pityopsis graminifolia	narrowleaf silkgrass			X		1
Pluchea foetida	stinking camphorweed	X				1
Polytrichum commune	moss	X				1
Pteridium aquilinum	bracken fern	X			X	2
Quercus geminata	sand live oak			**X**		1

Scientific Name	Common Name	Hydric Pine Flatwoods	Hydric Savanna	Pine Flatwoods	Wetland Forest Mixed	Grand Total
Quercus michauxii	swamp chestnut oak				X	1
Quercus nigra	water oak	X		X	X	3
Quercus virginiana	live oak				X	1
Rhexia nashii	maid marian	X				1
Rhexia petiolata	fringed meadowbeauty				X	1
Rhexia sp.	meadowbeauty				X	1
Rhexia virginica	handsome harry	X	X	X	X	4
Rhus copallinum	winged sumac	X				1
Rhynchospora baldwinii	Baldwin's beaksedge				X	1
Rhynchospora cephalantha	bunched beaksedge	X	X		X	3
Rhynchospora chalarocephala	loosehead beaksedge	X	X		X	3
Rhynchospora chapmanii	Chapman's beaksedge				X	1
Rhynchospora ciliaris	fringed beaksedge				X	1
Rhynchospora fascicularis	fascicled beaksedge		X		X	2
Rhynchospora glomerata	clustered beaksedge			**X**		1
Rhynchospora gracilenta	slender beaksedge	X			X	2
Rhynchospora inexpansa	nodding beaksedge	X				1
Rhynchospora inundata	narrowfruit horned beaksedge				**X**	1
Rhynchospora plumosa	plumed beaksedge				X	1
Rhynchospora sp.	beaksedge		X			1
Rubus cuneifolius	sand blackberry	X			X	2
Rubus pensilvanicus	sawtooth blackberry	X	X	X	X	4
Rubus trivialis	southern dewberry	X		X		2
Saccharum baldwinii	narrow plumegrass	X				1
Saccharum giganteum	sugarcane plumegrass		X	X		2
Sarracenia leucophylla	white-top pitcherplant				**X**	1
Sarracenia rosea	Gulf purple pitcherplant				**X**	1
Schizachyrium stoloniferum	creeping little bluestem	X				1
Scirpus cyperinus	woolgrass		X		X	2
Scleria baldwinii	Baldwin's nutrush				**X**	1
Scleria ciliata	fringed nutrush	X			X	2
Scleria triglomerata	whip nutrush	X			X	2
Serenoa repens	saw palmetto				X	1
Smilax auriculata	earleaf greenbrier	X		X		2
Smilax glauca	cat greenbrier	X		X	X	3
Smilax laurifolia	laurel greenbrier		X		X	2
Smilax pumila	sarsaparilla vine			**X**		1
Smilax walteri	coral greenbrier		X			1
Solidago fistulosa	pinebarren goldenrod	X	X	X	X	4
Sphagnum sp.	sphagnum moss	X	X		X	3
Styrax americanus	American snowbell	X				1
Symphyotrichum dumosum	rice button aster	X		X	X	3
Symplocos tinctoria	horse sugar	X				1

Scientific Name	Common Name	Hydric Pine Flatwoods	Hydric Savanna	Pine Flatwoods	Wetland Forest Mixed	Grand Total
Taxodium ascendens	pond cypress		X	**X**	X	3
Toxicodendron radicans	eastern poison ivy	X	X	X	X	4
†*Triadica sebifera*	Chinese tallow tree	X				1
Tridens ambiguus	pinebarren fluffgrass	X				1
Unknown moss			X		X	2
Vaccinium corymbosum	highbush blueberry	X	X	X	X	4
Vaccinium elliottii	Elliott's blueberry	X		X	X	3
Viburnum nudum	possumhaw	**X**		X	**X**	3
Viola lanceolata	bog white violet				X	1
Viola primulifolia	primroseleaf violet	X		X	X	3
Vitis rotundifolia	muscadine	X	X			2
Woodwardia areolata	netted chain fern	X		X	X	3
Woodwardia virginica	Virginia chain fern	X	X		X	3
Xyris ambigua	coastalplain yellow-eyed grass			X	X	2
Xyris baldwiniana	Baldwin's yellow-eyed grass				X	1
Xyris brevifolia	shortleaf yellow-eyed grass				X	1
Xyris caroliniana	Carolina yellow-eyed grass				X	1
Xyris elliottii	Elliott's yellow-eyed grass				X	1
Xyris fimbriata	fringed yellow-eyed grass		X		X	2
Xyris flabelliformis	savannah yellow-eyed grass				X	1
Xyris platylepis	tall yellow-eyed grass	X		X		2
Xyris sp.	yellow-eyed grass	X			X	2
Xyris stricta	pineland yellow-eyed grass				X	1
Total number of taxa: 182		**102**	**53**	**70**	**127**	352

Hydric Savanna

Qualitative sampling. The target community of Hydric Savanna (Figure 2) had a total of 53 observed plant species (Table 1). The groundcover was dominated by a dense cover of sphagnum moss and a diversity of herbaceous species with mostly weedy species, primarily purple bluestem and pinebarren goldenrod. Pinewoods bluestem, state-listed as threatened, was seen in this community in 2020 and 2021 along the qualitative meandering transect. It was not observed this year or last. Shrubs formed less than 5% cover, primarily limited to the slightly elevated windrows formed when the land was cleared for silviculture, and consisted mainly of sweetbay, myrtle-leaved holly, and large gallberry. Occasional slash pine and red maple saplings were widely scattered. Conditions in the hydric savanna were drier than usual in 2023.

Quantitative sampling. Transect 1 (Figure 3, Table 2) had a total of 23 species. Their total cover made up more than 100% of the area since a large amount of sphagnum moss underlay the other species. The dominant species were sphagnum moss, purple bluestem, pinebarren goldenrod, and loblolly pine. Woody species made up around 12% average cover per quadrat. Vegetation along the transect was very similar in composition to the previous year. There was a small decrease in cover from the dominant

species and a continued decrease in viviparous spikerush, likely a combination of seasonal effect and dry conditions.

Transect 2 (Figure 4, Table 3) had a total of 24 species which covered over 100% of the area. The dominant species were sphagnum moss, purple bluestem, pinebarren goldenrod, and smallfruit beggarticks. Woody species made up about 2% average cover per quadrat. Vegetation along the transect was very similar in composition to the previous year.

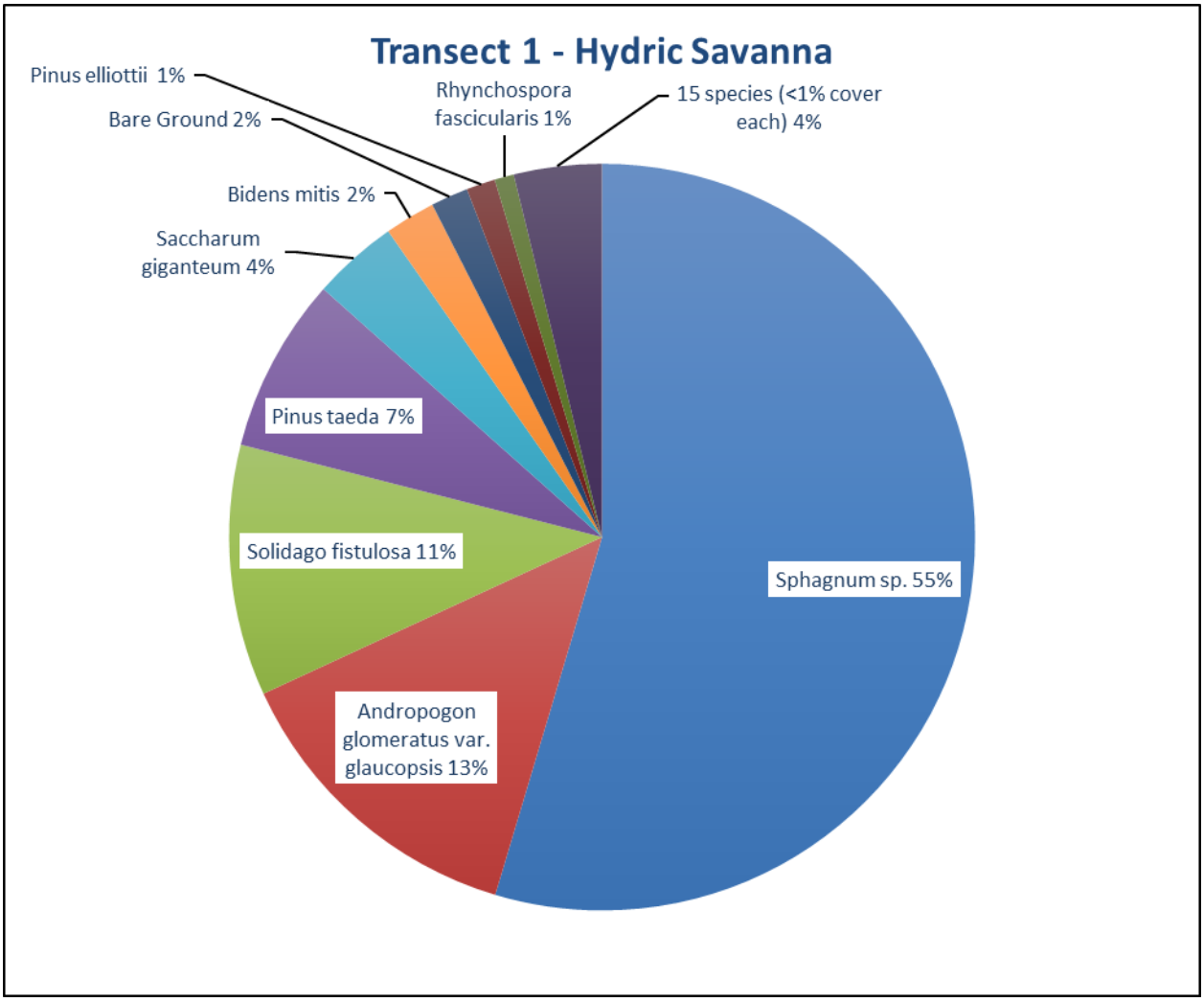

Figure 3. Percent relative cover of plant species in Hydric Savanna Transect 1.

Table 2. Percent cover of plant species in Hydric Savanna Transect 1 sampled on November 28, 2023.

Scientific name	Common name	Average percent cover per quadrat
Acer rubrum	red maple	0.69
Andropogon glomeratus* var. *glaucopsis	purple bluestem	16.13
Aronia arbutifolia	red chokeberry	0.06
Bidens mitis	smallfruit beggarticks	2.63

Eleocharis vivipara	viviparous spikerush	0.13
Eupatorium mohrii	Mohr's thoroughwort	0.25
Hydrocotyle umbellata	manyflower marshpennywort	0.56
Hypericum brachyphyllum	coastalplain St. John's wort	0.19
Ilex glabra	gallberry	0.44
Kellochloa verrucosa	warty panicgrass	0.06
Ludwigia pilosa	hairy primrosewillow	0.13
Persea palustris	swamp bay	0.13
Pinus elliottii	slash pine	1.50
Pinus taeda	loblolly pine	9.06
Rhynchospora cephalantha	bunched beaksedge	0.63
Rhynchospora fascicularis	fascicled beaksedge	1.00
Saccharum giganteum	sugarcane plumegrass	4.44
Solidago fistulosa	pinebarren goldenrod	13.00
***Sphagnum* sp.**	sphagnum moss	65.31
Toxicodendron radicans	eastern poison ivy	0.13
Vitis rotundifolia	muscadine	0.06
Woodwardia virginica	Virginia chain fern	0.63
Xyris fimbriata	fringed yellow-eyed grass	0.50
Bare Ground		1.94

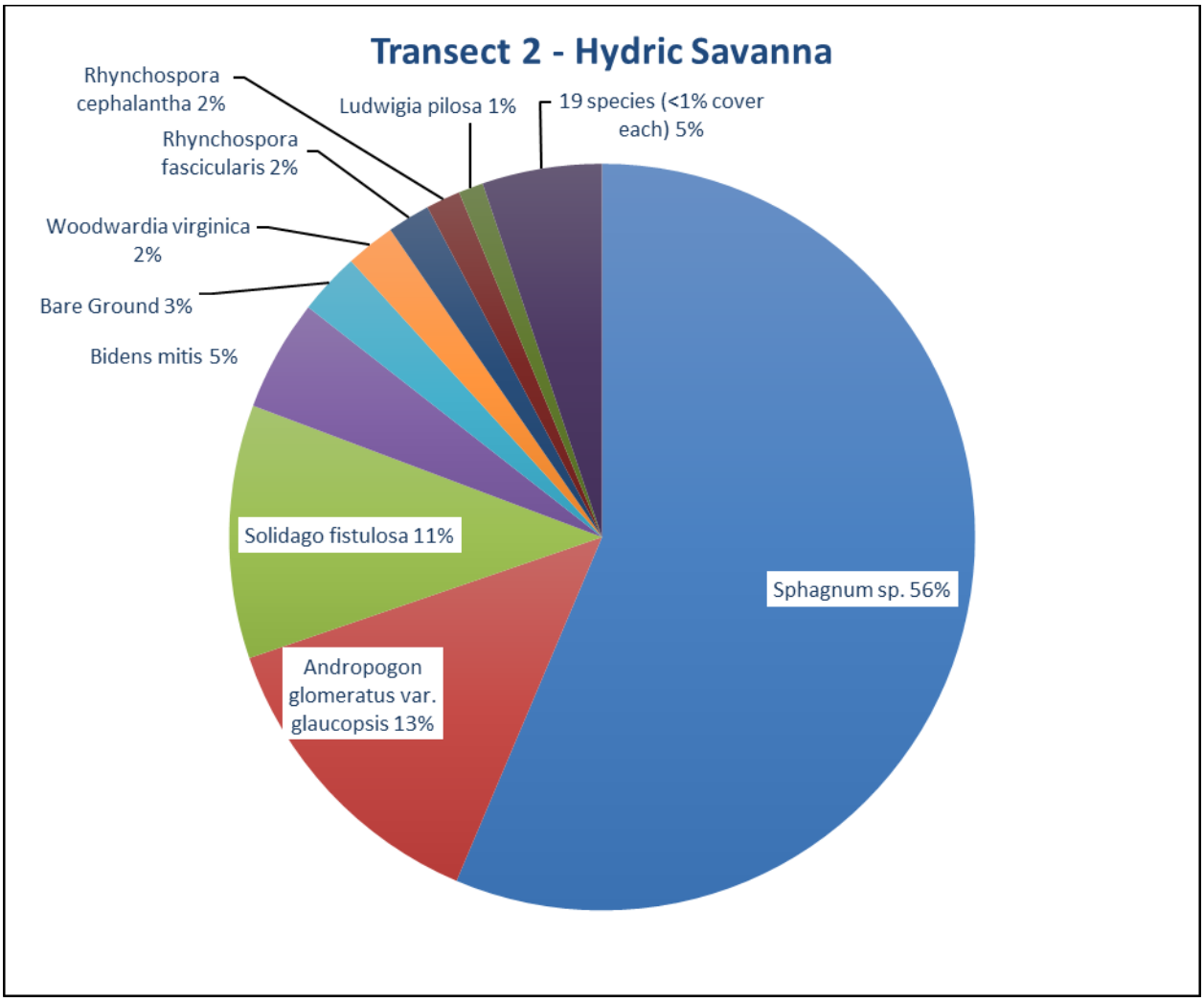

Figure 4. Percent relative cover of plant species in Hydric Savanna Transect 2.

Table 3. Percent cover of plant species in Hydric Savanna Transect 2 sampled on November 28, 2023.

Scientific name	Common name	Average percent cover per quadrat
Acer rubrum	red maple	0.31
Andropogon glomeratus* var. *glaucopsis	purple bluestem	14.00
Andropogon virginicus	broomsedge bluestem	0.94
Aronia arbutifolia	red chokeberry	0.06
Bidens mitis	smallfruit beggarticks	5.06
Centella asiatica	spadeleaf	0.19
Eleocharis vivipara	viviparous spikerush	0.13
Eupatorium mohrii	Mohr's thoroughwort	0.19
Euthamia caroliniana	slender flattop goldenrod	0.13
Hydrocotyle umbellata	manyflower marshpennywort	0.31
Hypericum crux-andreae	St. Peter's wort	0.19
Ilex coriacea	large gallberry	0.19

Juncus marginatus	grassleaf rush	0.06
Ludwigia pilosa	hairy primrosewillow	1.13
Morella cerifera	southern bayberry	0.44
moss	unknown moss	0.88
Pinus taeda	loblolly pine	0.06
Rhynchospora cephalantha	bunched beaksedge	1.56
Rhynchospora chalarocephala	loosehead beaksedge	0.19
Rhynchospora fascicularis	fascicled beaksedge	1.94
***Rhynchospora* sp.**	beaksedge	0.19
Rubus pensilvanicus	sawtooth blackberry	0.50
Saccharum giganteum	sugarcane plumegrass	0.19
Solidago fistulosa	pinebarren goldenrod	11.50
***Sphagnum* sp.**	sphagnum moss	59.06
Toxicodendron radicans	eastern poison ivy	0.31
Woodwardia virginica	Virginia chain fern	2.25
Bare Ground		2.81

Wetland Forest Mixed

Qualitative sampling. The target community of Wetland Forest Mixed (Figure 2) had a total of 127 observed plant species (Table 1). The vegetative cover in the western area was dominated by tall clumps of purple bluestem. Sphagnum moss and large Atlantic white cedars were common. Near the eastern transect 1 woody species, such as black titi, large gallberry, dahoon, sweetbay, fetterbush, and St. John's wort, have been reduced in recent years. Near the western transect 2, shrubs were taller and denser and have begun to form an open, low canopy. Young slash and loblolly pines were widely scattered throughout. The state-listed endangered white-top pitcherplant and state-listed threatened Gulf purple pitcherplant were both found in this community for the first time in 2023.

Quantitative sampling. Transect 1 had a total of 45 species and 29% bare ground (Figure 5, Table 4). The dominant species were purple bluestem, Atlantic white cedar, black titi, and sphagnum moss. The pines and other woody species are starting to form a shrubbier, more closed habitat in this area. Woody species made up around 29% average cover per quadrat, a slight increase from 2022, owing in part to an increase in black titi. Purple bluestem was slightly reduced compared to last year.

Transect 2 (Figure 6, Table 5) had a total of 54 species with 10% bare ground. The overall aspect was more open than Transect 1 and had less woody cover. Sphagnum moss, foxtail club-moss, black titi, and Virginia chain fern were dominants. Woody species made up around 18% average cover per quadrat, a slight increase from last year owing in part to an increase in black titi.

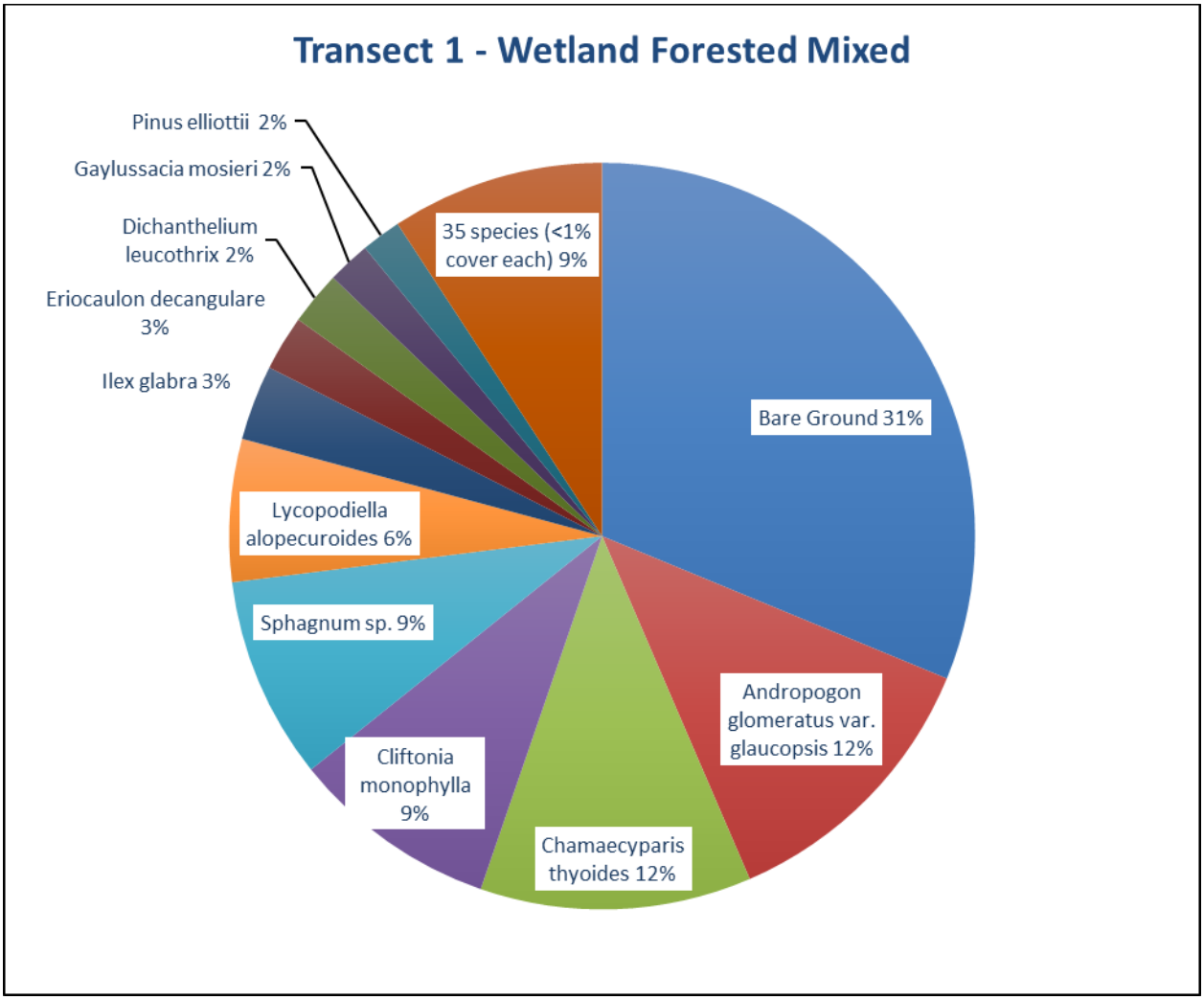

Figure 5. Percent relative cover of plant species in Mixed Forested Wetland Transect 1.

Table 4. Percent cover of plant species in Mixed Forested Wetland Transect 1 sampled on November 28, 2023.

Scientific name	Common name	Average percent cover per quadrat
Andropogon glomeratus* var. *glaucopsis	purple bluestem	11.56
***Andropogon* sp.**	bluestem	0.19
Aronia arbutifolia	red chokeberry	0.06
Chamaecyparis thyoides	Atlantic white cedar	11.06
Cliftonia monophylla	black titi	8.44
Dichanthelium leucothrix	rough witchgrass	2.19
Drosera brevifolia	dwarf sundew	0.06
Eriocaulon decangulare	tenangle pipewort	2.25
Euthamia caroliniana	slender flattop goldenrod	0.13
Gaylussacia mosieri	woolly huckleberry	1.75
Hypericum brachyphyllum	coastalplain St. John's wort	0.44
Hypericum cistifolium	roundpod St. John's wort	0.13

Scientific name	Common name	Average percent cover per quadrat
Hypericum crux-andreae	St. Peter's wort	0.06
Hypericum hypericoides	St. Andrew's cross	0.06
Ilex coriacea	large gallberry	0.06
Ilex glabra	gallberry	3.06
Juncus marginatus	grassleaf rush	0.06
Kellochloa verrucosa	warty panicgrass	0.25
Lachnocaulon anceps	whitehead bogbutton	0.38
Lycopodiella alopecuroides	foxtail club-moss	5.81
Lyonia lucida	fetterbush	0.94
Magnolia virginiana	sweetbay	0.19
Morella cerifera	southern bayberry	0.44
moss	unknown moss	0.13
Oldenlandia uniflora	clustered mille graines	0.13
Pinus elliottii	slash pine	1.63
Pinus taeda	loblolly pine	0.06
***Rhexia* sp.**	meadowbeauty	0.06
Rhynchospora cephalantha	bunched beaksedge	0.81
Rhynchospora ciliaris	fringed beaksedge	0.31
Rhynchospora fascicularis	fascicled beaksedge	0.38
Rhynchospora gracilenta	slender beaksedge	0.69
Rubus pensilvanicus	sawtooth blackberry	0.06
Scleria ciliata	fringed nutrush	0.06
Smilax glauca	cat greenbrier	0.50
Smilax laurifolia	laurel greenbrier	0.06
Solidago fistulosa	pinebarren goldenrod	0.13
***Sphagnum* sp.**	sphagnum moss	8.25
Taxodium ascendens	pond cypress	0.19
Woodwardia areolata	netted chain fern	0.06
Woodwardia virginica	Virginia chain fern	0.31
Xyris baldwiniana	Baldwin's yellow-eyed grass	0.38
Xyris brevifolia	shortleaf yellow-eyed grass	0.25
Xyris caroliniana	Carolina yellow-eyed grass	0.19
***Xyris* sp.**	yellow-eyed grass	0.50
Bare Ground		29.38

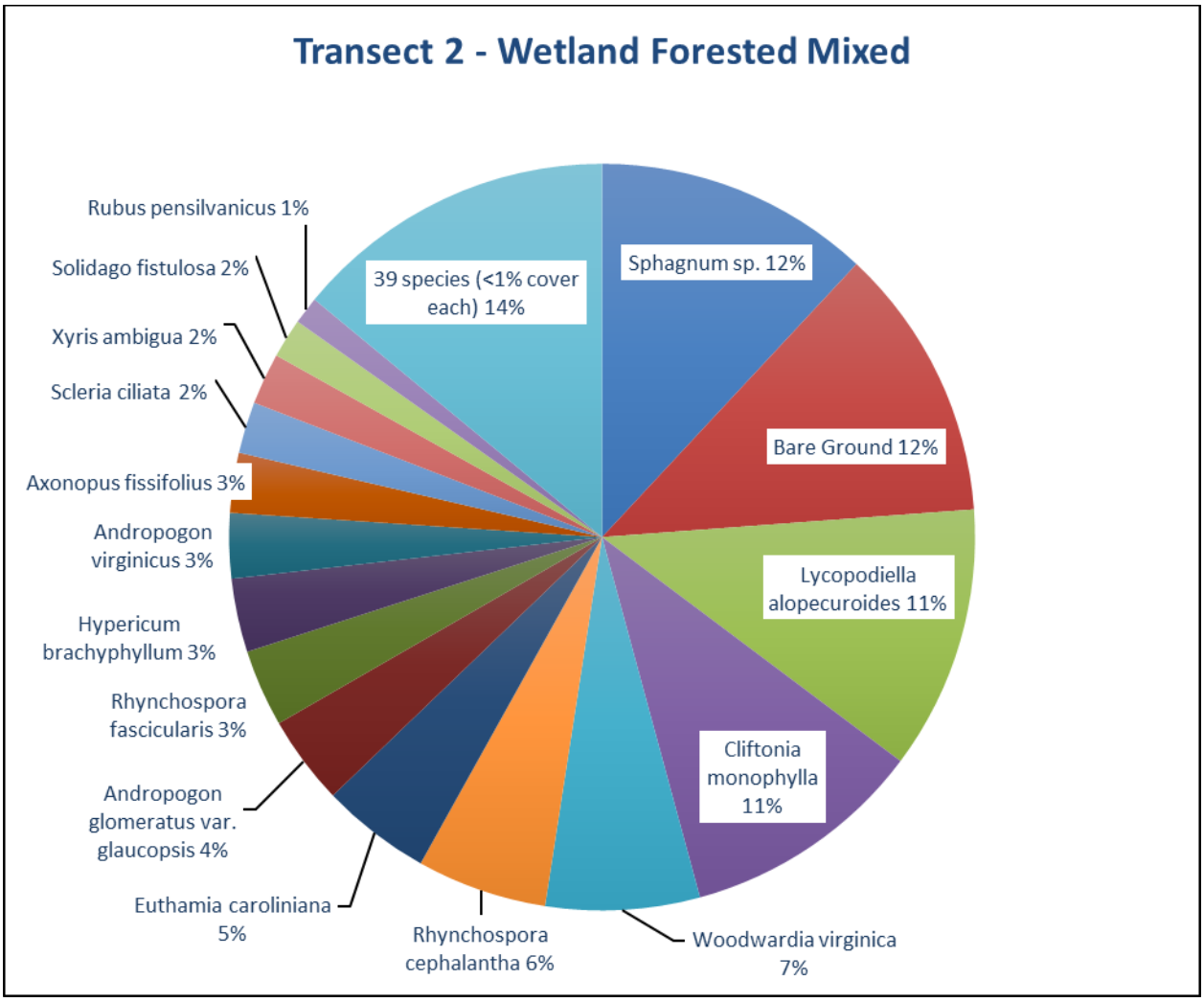

Figure 6. Percent relative cover of plant species in Mixed Forested Wetland Transect 2.

Table 5. Percent cover of plant species in Mixed Forested Wetland Transect 2 sampled on November 28, 2023.

Scientific name	Common name	Average percent cover per quadrat
Acer rubrum	red maple	0.06
Aletris lutea	yellow colic-root	0.50
Andropogon glomeratus* var. *glaucopsis	purple bluestem	3.25
Andropogon virginicus	broomsedge bluestem	2.38
Axonopus fissifolius	common carpetgrass	2.19
Bidens mitis	smallfruit beggarticks	0.19
Centella asiatica	spadeleaf	0.06
Cliftonia monophylla	black titi	8.88
Coleataenia longifolia	ciliate redtop panicum	0.19
Dichanthelium ensifolium	cypress witchgrass	0.63
Dichanthelium scabriusculum	woolly witchgrass	0.44

Scientific name	Common name	Average percent cover per quadrat
Drosera brevifolia	dwarf sundew	0.06
Eragrostis elliottii	Elliott's lovegrass	0.13
Eriocaulon compressum	flattened pipewort	0.13
Eupatorium mohrii	Mohr's thoroughwort	0.06
Eupatorium pilosum	rough boneset	0.25
***Eupatorium* sp.**	thoroughwort	0.19
Euthamia caroliniana	slender flattop goldenrod	4.00
Gaylussacia mosieri	woolly huckleberry	0.63
Hypericum brachyphyllum	coastalplain St. John's wort	2.69
Hypericum crux-andreae	St. Peter's wort	0.13
***Hypericum* sp.**	St. John's wort	0.06
Ilex cassine* var. *myrtifolia	myrtle-leaved holly	0.94
Ilex glabra	gallberry	0.06
Juncus marginatus	grassleaf rush	0.31
Kellochloa verrucosa	warty panicgrass	0.06
Lachnocaulon anceps	whitehead bogbutton	0.06
Ludwigia pilosa	hairy primrosewillow	0.06
Lycopodiella alopecuroides	foxtail club-moss	9.63
Magnolia virginiana	sweetbay	0.94
moss	unknown moss	0.06
Oldenlandia uniflora	clustered mille graines	0.38
Persea palustris	swamp bay	0.38
Pinus taeda	loblolly pine	0.56
***Rhexia* sp.**	meadowbeauty	0.06
Rhexia virginica	handsome harry	0.31
Rhynchospora cephalantha	bunched beaksedge	4.75
Rhynchospora chalarocephala	loosehead beaksedge	0.44
Rhynchospora ciliaris	fringed beaksedge	0.44
Rhynchospora fascicularis	fascicled beaksedge	2.81
Rhynchospora gracilenta	slender beaksedge	0.56
Rubus pensilvanicus	sawtooth blackberry	1.00
Scleria ciliata	fringed nutrush	1.88
Smilax glauca	cat greenbrier	0.69
Smilax laurifolia	laurel greenbrier	0.50
Solidago fistulosa	pinebarren goldenrod	1.44
***Sphagnum* sp.**	sphagnum moss	10.06
Taxodium ascendens	pond cypress	0.06
Viola lanceolata	bog white violet	0.56
Viola primulifolia	primroseleaf violet	0.13
Woodwardia areolata	netted chain fern	0.44
Woodwardia virginica	Virginia chain fern	5.63
Xyris ambigua	coastalplain yellow-eyed grass	1.88
***Xyris* sp.**	yellow-eyed grass	0.13
Bare Ground		10.00

Hydric Pine Flatwoods

Qualitative monitoring. The target community of hydric pine flatwoods had a total of 102 plant species observed in 2023 (Table 1). The 60-100-foot planted loblolly pines were thinned in 2017 by cutting selected rows of trees off near ground level. The resulting logs were left where they fell on the ground. Recent tropical storms have felled additional trees. During the 2023 sampling effort, these logs were continuing to decompose, and a few more trees were down from recent storms. Vines of muscadine grape were common and often dense. Much of the ground was covered by a thick layer of pine needle litter. The herbaceous layer was dominated by cinnamon fern, broomsedge bluestem, toothache grass, and wiregrass, as well as many weedy species. Curtiss' sandgrass (*Calamovilfa curtissii*), state listed as threatened, is known from this community and was confirmed present this year. Two non-native invasive species, Japanese climbing fern and Chinese tallow tree, have been noted in this community in prior years and still persist.

Quantitative monitoring. Where branches of the felled pines lay across the quadrats, they were moved aside in order to view the plants beneath. This woody debris is starting to decompose. Transect 1 had a total of 33 species with 68% bare ground (Figure 7, Table 6). The dominant species were loblolly pine and muscadine. Some decrease was seen in muscadine and cinnamon fern cover, but this may have been attributable to late season senescence. Woody species (including muscadine) made up around 11% average cover per quadrat, similar to last year.

Transect 2 (Figure 8, Table 7) had a total of 44 species with 44% bare ground. The dominant species were wiregrass, loblolly pine, and broomsedge bluestem, with wiregrass continuing to increase in cover. Woody species made up around 12% average cover per quadrat, a slight increase from last year. A large, downed pine tree (present since 2020) at the beginning of the transect is continuing to decompose, but still creates difficulties for sampling.

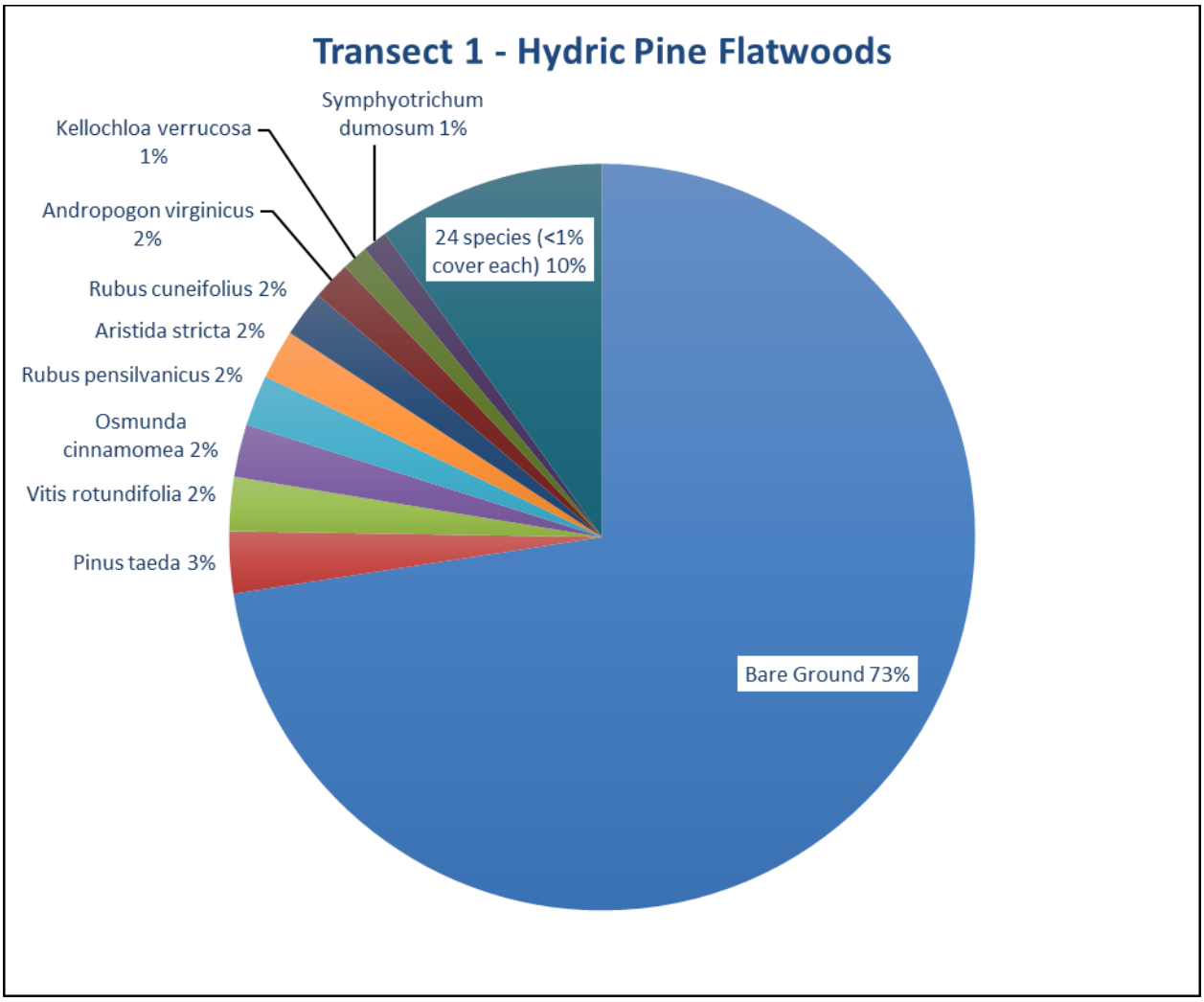

Figure 7. Percent relative cover of plant species in Hydric Pine Flatwoods Transect 1.

Table 6. Percent cover of species in Hydric Pine Flatwoods Transect 1 sampled on November 28, 2023.

Scientific name	Common name	Average percent cover per quadrat
Acer rubrum	red maple	0.63
Ageratina aromatica	lesser snakeroot	0.19
Andropogon glomeratus	bushy bluestem	0.50
Andropogon virginicus	broomsedge bluestem	1.56
Aristida stricta	wiregrass	2.00
Calamovilfa curtissii	Curtiss' sandgrass	0.06
Centella asiatica	spadeleaf	0.06
Coleataenia longifolia	ciliate redtop panicum	0.44
Ctenium aromaticum	toothache grass	0.94
***Dichanthelium* sp.**	witchgrass	0.25
Elephantopus elatus	tall elephantsfoot	0.69
Eupatorium capillifolium	dogfennel	0.44

Scientific name	Common name	Average percent cover per quadrat
Eupatorium pilosum	rough boneset	0.06
Euthamia caroliniana	slender flattop goldenrod	0.81
Hypericum crux-andreae	St. Peter's wort	0.44
Juncus marginatus	grassleaf rush	0.19
Kellochloa verrucosa	warty panicgrass	1.06
Magnolia virginiana	sweetbay	0.19
Oldenlandia uniflora	clustered mille graines	0.38
Osmunda cinnamomea	cinnamon fern	2.13
Pinus taeda	loblolly pine	2.50
Rubus cuneifolius	sand blackberry	1.88
Rubus pensilvanicus	sawtooth blackberry	2.06
Scleria ciliata	fringed nutrush	0.38
Smilax auriculata	earleaf greenbrier	0.44
Smilax glauca	cat greenbrier	0.44
Solidago fistulosa	pinebarren goldenrod	0.88
Symphyotrichum dumosum	rice button aster	1.00
Toxicodendron radicans	eastern poison ivy	0.56
Viola primulifolia	primroseleaf violet	0.06
Vitis rotundifolia	muscadine	2.19
Woodwardia areolata	netted chain fern	0.19
Xyris platylepis	tall yellow-eyed grass	0.06
Bare Ground		67.81

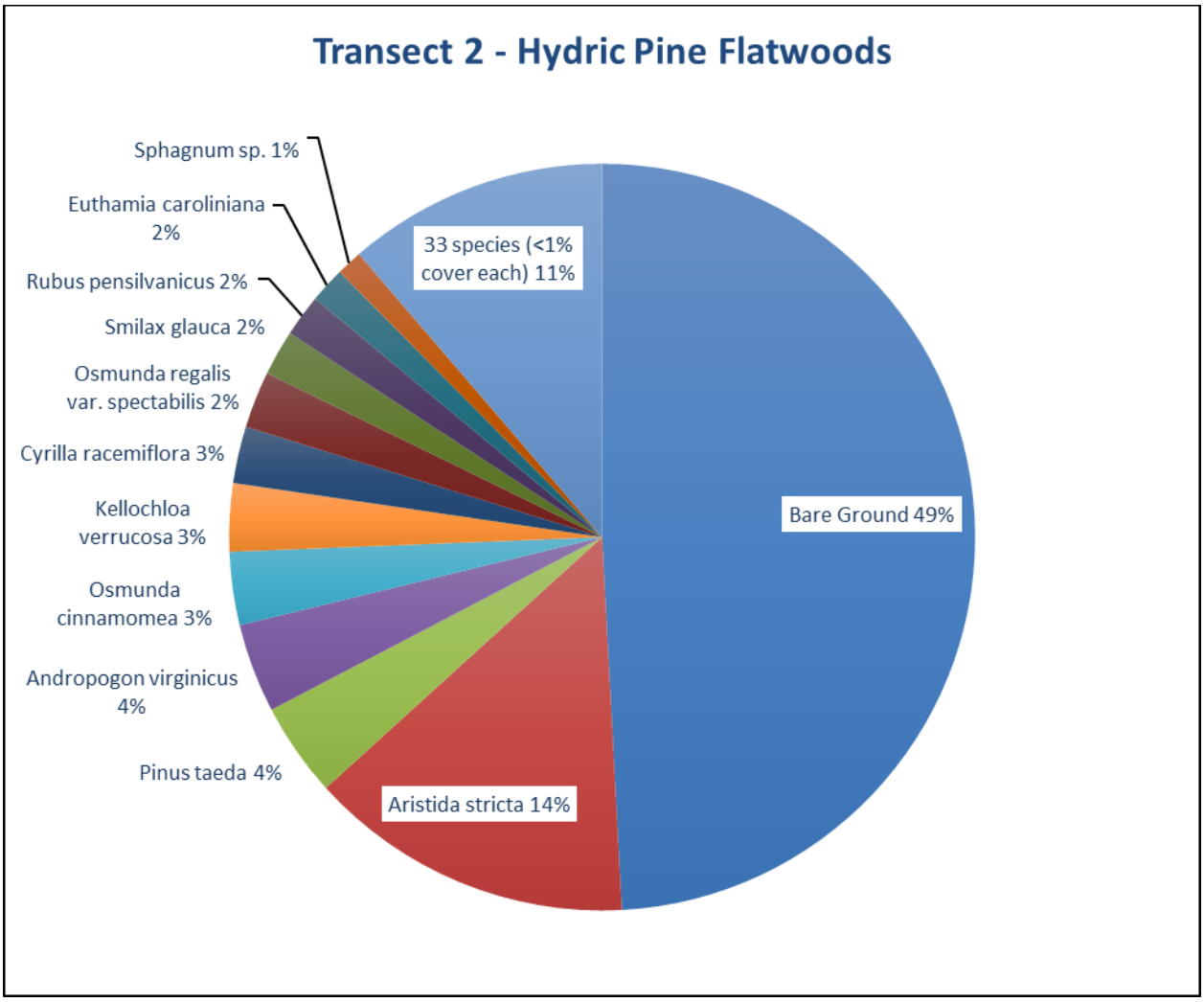

Figure 8. Percent relative cover of plant species in Hydric Pine Flatwoods Transect 2.

Table 7. Percent cover of plant species in Hydric Pine Flatwoods Transect 2 sampled on November 28, 2023.

Scientific name	Common name	Average percent cover per quadrat
Acer rubrum	red maple	0.25
Andropogon glomeratus* var. *glaucopsis	purple bluestem	0.44
Andropogon virginicus	broomsedge bluestem	3.44
Aristida stricta	wiregrass	12.56
Calamovilfa curtissii	Curtiss' sandgrass	0.06
Carex longii	Long's sedge	0.94
Centella asiatica	spadeleaf	0.25
Ctenium aromaticum	toothache grass	0.06
Cyrilla racemiflora	titi	2.19
Dichanthelium scabriusculum	woolly witchgrass	0.06
***Dichanthelium* sp.**	witchgrass	0.19
Elephantopus elatus	tall elephantsfoot	0.31

Eupatorium mohrii	Mohr's thoroughwort	0.06
Euthamia caroliniana	slender flattop goldenrod	1.38
Helianthus angustifolius	narrowleaf sunflower	0.06
Hypericum crux-andreae	St. Peter's wort	0.56
Ilex cassine* var. *myrtifolia	myrtle-leaved holly	0.06
***Juncus* sp.**	rush	0.44
Kellochloa verrucosa	warty panicgrass	2.63
Lachnocaulon anceps	whitehead bogbutton	0.25
Ludwigia maritima	seaside primrosewillow	0.06
Lycopodiella alopecuroides	foxtail club-moss	0.19
Magnolia virginiana	sweetbay	0.06
Oldenlandia uniflora	clustered mille graines	0.19
Osmunda cinnamomea	cinnamon fern	2.81
Osmunda regalis* var. *spectabilis	royal fern	2.19
Persea palustris	swamp bay	0.19
Pinus taeda	loblolly pine	3.63
Pteridium aquilinum	bracken	0.19
***Rhexia* sp.**	meadowbeauty	0.13
Rhynchospora gracilenta	slender beaksedge	0.19
Rhynchospora inexpansa	nodding beaksedge	0.19
***Rhynchospora* sp.**	beaksedge	0.06
Rubus pensilvanicus	sawtooth blackberry	1.63
Smilax glauca	cat greenbrier	1.75
Solidago fistulosa	pinebarren goldenrod	0.38
***Sphagnum* sp.**	sphagnum moss	1.00
Symphyotrichum dumosum	rice button aster	0.44
Vaccinium elliottii	Elliott's blueberry	0.69
Viola primulifolia	primroseleaf violet	0.94
Vitis rotundifolia	muscadine	0.75
Woodwardia areolata	netted chain fern	0.94
Woodwardia virginica	Virginia chain fern	0.44
***Xyris* sp.**	yellow-eyed grass	0.06
Bare Ground		43.75

Pine Flatwoods

Qualitative monitoring. The mature pines were thinned in 2017 by cutting selected rows of trees off near ground level. The resulting logs were left where they fell on the ground. The hardwoods in the subcanopy had been cut down in 2014 and some stumps have re-sprouted. Muscadine vine was abundant, scrambling over and obscuring much of the remaining groundcover. There was a diverse shrub layer dominated by sweetbay, swamp bay, St. John's worts, southern bayberry, sawtooth blackberry and young loblolly pines. In the herbaceous layer were scattered clumps of wiregrass, with abundant broomsedge bluestem and pinebarren goldenrod. Several new herbs were found this year. A total of 70 species (Table 1) were observed in this habitat.