ANNUAL MONITORING REPORT YEAR 1 (2010)

FOX RUN RIPARIAN BUFFER MITIGATION SITE PITT COUNTY, NORTH CAROLINA

(EEP Contract No. 002281)



Prepared for:

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES ECOSYSTEM ENHANCEMENT PROGRAM RALEIGH, NORTH CAROLINA



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November 2010

EXECUTIVE SUMMARY

Restoration Systems, LLC has completed riparian buffer restoration at the Fox Run Riparian Buffer Mitigation Site (hereafter referred to as the "Site") through the North Carolina Ecosystem Enhancement Program (NCEEP) Full Delivery Process (RFP 16-001383) to provide 43.72 Riparian Buffer Mitigation Units. The Site is located approximately 2.5 miles southeast of Farmville in western Pitt County. The Site is located in United States Geological Survey Hydrologic Unit and Targeted Local Watershed 03020203070030 (North Carolina Division of Water Quality Subbasin 03-04-07) of the Neuse River Basin. Site streams drain to Little Contentnea Creek (Stream Index 27-86-26), which is included on the draft 2008 and 2010 303(d) lists for impaired biological integrity and low dissolved oxygen resulting from agricultural crop production.

Prior to construction, the Site was characterized by ditched agricultural land used for row crop production. Land use practices including the maintenance and removal of vegetation, regular plowing, and use of agricultural chemicals had resulted in degraded water quality.

The goals and objectives of this project focused on improving local water quality, enhancing flood attenuation, and restoring aquatic and riparian habitat. These goals were accomplished by the following.

- Removing nonpoint sources of pollution associated with agriculture production by a) ceasing the
 application of agricultural herbicides, pesticides, fertilizers, and other agricultural materials into
 and adjacent to Site ditches and open waterways and b) providing a vegetative buffer adjacent to
 ditches and waterways to treat surface runoff that may be laden with sediment and/or agricultural
 pollutants.
- 2. Reducing sedimentation/siltation within on-Site and downstream receiving waters by a) increasing retention time for surface waters entering and leaving the Site, b) reducing erosion associated with vegetation maintenance and agricultural plowing to Site ditches, and c) planting a forested vegetative buffer adjacent to Site ditches and waterways.
- 3. Promoting floodwater attenuation by ripping compacted soils and revegetating the Site to increase frictional resistance on floodwaters crossing the Site.
- 4. Providing terrestrial wildlife habitat including a forested riparian corridor within an area that was previously cleared and highly dissected by agricultural land use.

This project was constructed/planted on March 8, 2010. Planting of the entire 46.46-acre Site resulted in 43.72 Riparian Buffer Mitigation Units. As a whole, the densities of vegetation plots across the Site were above the required 320 stems per acre with an average of 756 planted stems per acre in the First Monitoring Year (2010). In addition, each individual plot met success criteria based on planted stems alone.

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1.0 INTRODUCTION

1.1 Location and Setting

Restoration Systems, LLC has completed riparian buffer restoration at the Fox Run Riparian Buffer Mitigation Site (hereafter referred to as the "Site") through the North Carolina Ecosystem Enhancement Program (NCEEP) Full Delivery Process (RFP 16-001383) to provide 43.72 Riparian Buffer Mitigation Units. The Site is located approximately 2.5 miles southeast of Farmville in western Pitt County (Figure 1, Appendix A). The Site is located in United States Geological Survey Hydrologic Unit and Targeted Local Watershed 03020203070030 (North Carolina Division of Water Quality Subbasin 03-04-07) of the Neuse River Basin (USGS 1974).

Directions to the Site from Farmville, North Carolina:

- > Take Maye-Turnage Road east
- ➤ After passing Chinquapin Road the Site is ~ 2 miles ahead on left
- > Site coordinates:
 - o Latitude 35.5702°N, Longitude 77.54272°W (NAD83/WGS84)

1.2 Project Goals and Objectives

The goals and objectives of this project focused on improving local water quality, enhancing flood attenuation, and restoring aquatic and riparian habitat. These goals were accomplished by the following.

- 1. Removing nonpoint sources of pollution associated with agriculture production by a) ceasing the application of agricultural herbicides, pesticides, fertilizers, and other agricultural materials into and adjacent to Site ditches and open waterways and b) providing a vegetative buffer adjacent to ditches and waterways to treat surface runoff that may be laden with sediment and/or agricultural pollutants.
- 2. Reducing sedimentation/siltation within on-Site and downstream receiving waters by a) increasing retention time for surface waters entering and leaving the Site, b) reducing erosion associated with vegetation maintenance and agricultural plowing to Site ditches, and c) planting a forested vegetative buffer adjacent to Site ditches and waterways.
- 3. Promoting floodwater attenuation by ripping compacted soils and revegetating the Site to increase frictional resistance on floodwaters crossing the Site.
- 4. Providing terrestrial wildlife habitat including a forested riparian corridor within an area that was previously cleared and highly dissected by agricultural land use.

1.3 Project Structure, Restoration Type, and Approach

Prior to construction, the Site was characterized by ditched agricultural land used for row crop production. Land use practices including the maintenance and removal of vegetation, regular plowing, and use of agricultural chemicals had resulted in degraded water quality.

As constructed, Site activities restored historic riparian buffer functions by planting the entire 46.46-acre Site with native riparian vegetation. This resulted in 43.72 Riparian Buffer Mitigation Units (Table 1, Appendix B and Figure 2, Appendix A). Approximately 2.32 acres of the Site is surface water associated with Site ditches and 0.42 acres of the Site exist outside of the 200-foot buffer area or within areas of nondiffuse flow. The target natural community consisted of Coastal Plain Bottomland Hardwood Forest (Schafale and Weakley 1990). Table 5 (Appendix C) outlines woody species planted within the Site. Completed project activities, reporting history, completion dates, project contacts, and background information are summarized in Tables 2-4 (Appendix B).

2.0 MONITORING PLAN

Monitoring of Site restoration efforts will be performed for vegetation components of the Site for five years or until success criteria are fulfilled. After planting was completed, an initial evaluation was performed to verify planting methods were successful and to determine initial species composition and density. Twenty-five sample vegetation plots (10-meter by 10-meter) were installed within the Site as per guidelines established in CVS-EEP Protocol for Recording Vegetation, Version 4.0 (Lee et al. 2006). In each sample plot, vegetation parameters to be monitored include species composition and species density. Visual observations of the percent cover of shrub and herbaceous species will also be documented by photograph.

2.1 Vegetation Success Criteria

Characteristic Tree Species include woody tree and shrub species planted at the Site (Table 5, Appendix C) or outlined for the appropriate plant community in Schafale and Weakley (1990). An average density of 320 stems per acre of Characteristic Tree Species must be surviving after year 5 monitoring throughout the site.

2.2 Maintenance and Contingency

In the event that success criteria are not fulfilled, a mechanism for contingency will be implemented. If vegetation success criteria are not achieved based on average density calculations from combined plots over the entire restoration area, supplemental planting may be performed with tree species approved by regulatory agencies. Supplemental planting will be performed as needed until achievement of vegetation success criteria.

2.3 Vegetation Sampling Results and Comparison to Success Criteria

Quantitative sampling of vegetation was conducted on September 13-17, 2010. Results are provided in Appendix C. Vegetation success criteria for year 1 (320 stems per acre) were exceeded for the 2010 annual monitoring year with an average density of 756 planted stems per acre across the Site. In addition, each individual plot met success criteria based on planted stems alone.

3.0 CONCLUSIONS

As a whole, the densities of vegetation plots across the Site were above the required 320 stems per acre with an average of 756 planted stems per acre in the First Monitoring Year (2010). In addition, each individual plot met success criteria based on planted stems alone.

Summary of Planted Stem Vegetation Plot Results

Summary of Franced St			nted Stems/Acro	9	
Plot	Year 1 (2010)	Year 2 (2011)	Year 3 (2012)	Year 4 (2013)	Year 5 (2014)
1		(2011)	(2012)	(2013)	(2014)
1	688				
2	769				
3	809				
4	688				
5	850				
6	607				
7	931				
8	688				
9	728				
10	769				
11	971				
12	688				
13	769				
14	769				
15	728				
16	688				
17	567				
18	567				
19	688				
20	607				
21	1133				
22	728				
23	809				
24	728				
25	931				
Average Plots 1-25	756				

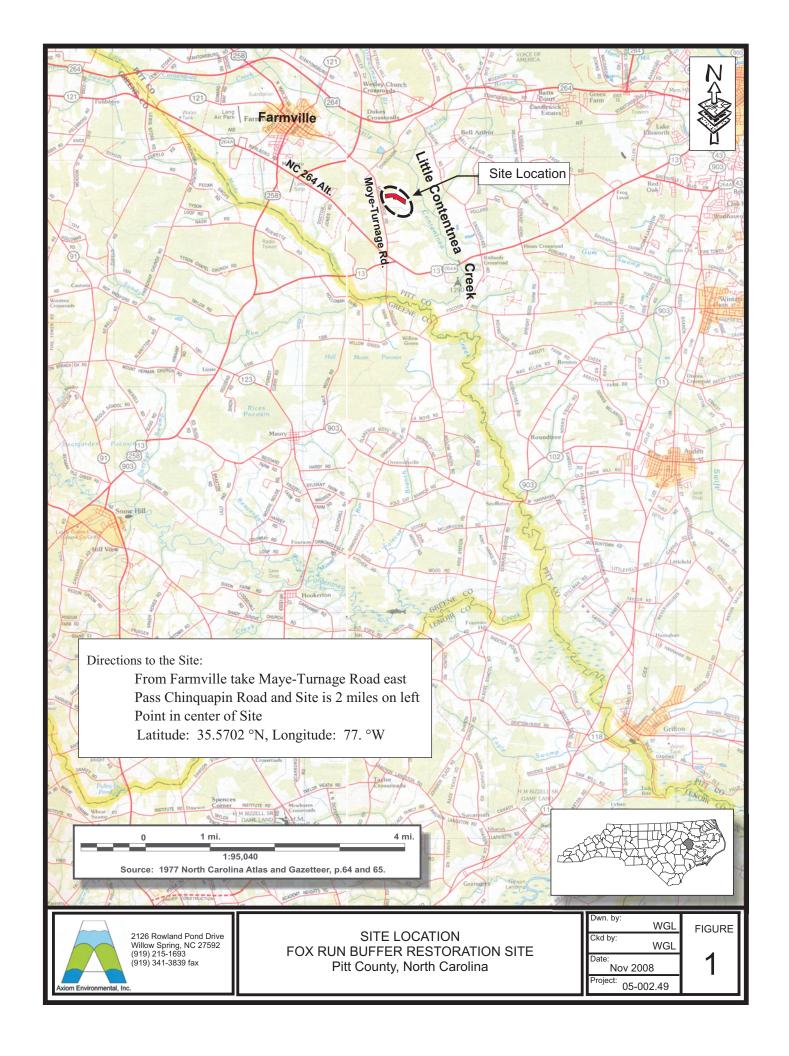
4.0 REFERENCES

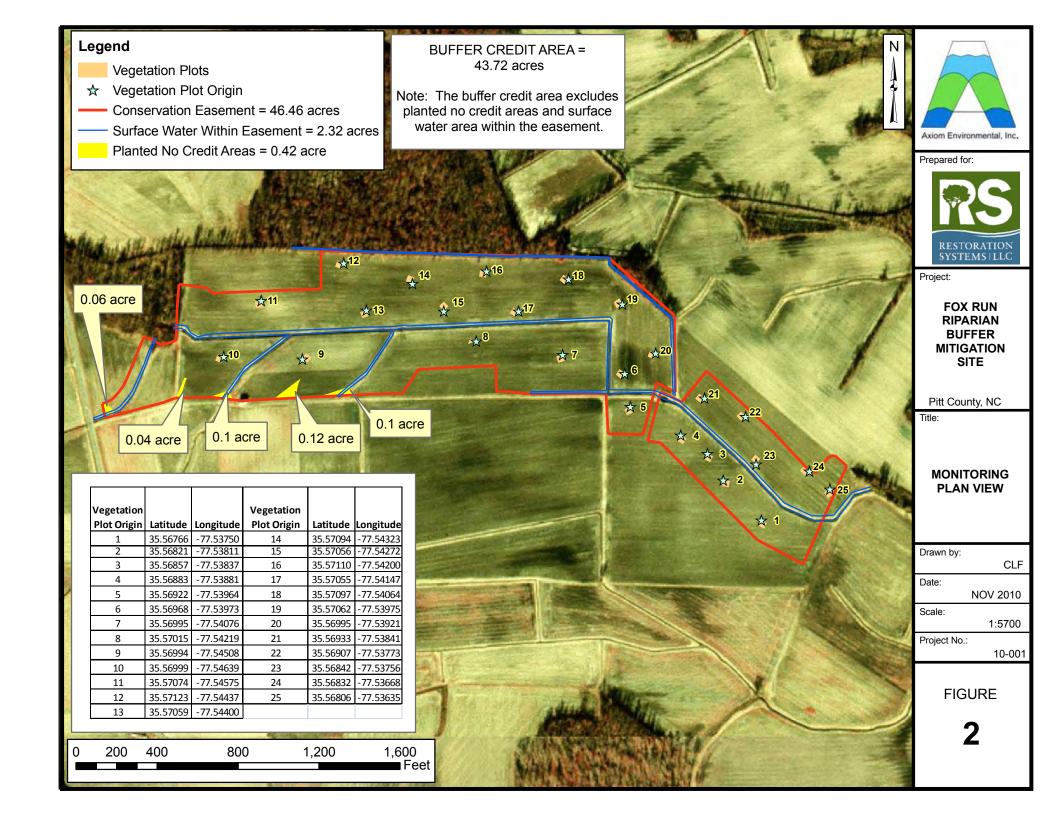
- Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation. Version 4.0. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, North Carolina.
- North Carolina Division of Water Quality (NCDWQ). 2007. Redbook, Surface Waters and Wetlands Standards. North Carolina Department of Environment and Natural Resources, Division of Water Quality. Raleigh, North Carolina.
- North Carolina Division of Water Quality (NCDWQ). 2008a. Draft North Carolina Water Quality Assessment and Impaired Waters List (2008 Integrated 305(b) and 303(d) Report) (online). Available: http://h2o.enr.state.nc.us/tmdl/documents/B.Draft2008303dList.pdf [November 10, 2008]. North Carolina Department of Environment and Natural Resources, Raleigh, North Carolina.
- North Carolina Division of Water Quality (NCDWQ). 2008b. Draft Basinwide Planning Program: Neuse River Basinwide Water Quality Plan-June 2008. North Carolina Department of Environment and Natural Resources, Division of Water Quality. Raleigh, North Carolina.
- North Carolina Division of Water Quality (NCDWQ). 2010. Draft North Carolina Water Quality Assessment and Impaired Waters List (2010 Integrated 305(b) and 303(d) Report) (online). Available: http://portal.ncdenr.org/c/document_library/get_file? uuid=33a71505-6cdf-4497-b090-aadf79b1f02c&groupId=38364 [August 23, 2010]. North Carolina Department of Environment and Natural Resources, Raleigh, North Carolina.
- Schafale, M.P. and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina: Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, North Carolina Department of Environment, Health, and Natural Resources. Raleigh, North Carolina.

United States Geological Survey (USGS). 1974. Hydrologic Unit Map - 1974. State of North Carolina.

Appendix A. Figures

Figure 1. Site Location Figure 2. Monitoring Plan View





Appendix B. General Tables

Table 1. Site Restoration Structures and Objectives
Table 2. Project Activity and Reporting History
Table 3. Project Contacts Table
Table 4. Project Attributes Table

Table 1. Site Restoration Structures and Objectives

Component Summation				
Restoration Level	Riparian buffer mitigation was completed by planting the entire 46.46-acre			
Riparian Buffer Restoration	Site with native forest vegetation; credit was received for 43.72 acres of the			
43.72 Buffer Mitigation Units	Site.			

Table 2. Project Activity and Reporting History

Activity or Report	Data Collection Complete	Completion or Delivery
Final Restoration Plan		November 2010
Site Planting		March 8, 2010
Asbuilt Mitigation Plan	April 2010	November 2010
Year 1 Monitoring	September 13-17,	November 2010
	2010	

Table 3. Project Contacts Table

Table 5. 110ject Contacts Table				
Designer	Restoration Systems, LLC			
	1101 Haynes Street, Suite 211			
	Raleigh, North Carolina 27604			
	(919) 755-9490			
Planting Contractor	Carolina Silvics			
	908 Indian Trail Road			
	Edenton, North Carolina 27932			
	Dwight McKinney (252) 482-8491			
Monitoring Performer	Axiom Environmental, Inc.			
	20 Enterprise Street, Suite 7			
	Raleigh, North Carolina 27607			
	Grant Lewis (919) 215-1693			

Table 4. Project Attribute Table

Project County	Pitt County, North Carolina
Physiographic Region	Coastal Plain
Ecoregion	Southeastern Plains
Project River Basin	Neuse
USGS 14-digit HUC	03020203070030
NCDWQ Subbasin	03-04-07
Within EEP Watershed Plan Extent?	Yes-Targeted Local Watershed
WRC Class	Warm
% of project easement fenced	0 %
Beaver activity observed during design phase	No

Appendix C. Vegetation Data

Table 5. Planted Woody Species Vegetation Survey Data Tables Vegetation Monitoring Plot Photographs

Table 5. Planted Woody Vegetation

Species	Quantity
American elm (Ulmus americana)	7500
Black gum (Nyssa sylvatica)	2500
Elderberry (Sambucus canadensis)	2500
Loblolly pine (Pinus taeda)	7500
Northern red oak (Quercus rubra)	5000
River birch (Betula nigra)	2500
Sugarberry (Celtis laevigata)	2500
Swamp chestnut oak (Quercus michauxii)	7500
Sycamore (Platanus occidentalis)	3200
Willow oak (Quercus phellos)	7500
TOTAL	50,000

CVS Database Output

Living planted stems, excluding live stakes, per acre: Negative (red) numbers indicate the project failed to reach requirements in a particular year.

Project Code	Project Name	River Basin	Year 1
Fox Run	Fox Run	Neuse	755.95

Total stems, including planted stems of all kinds (including live stakes) and natural/volunteer stems:

Project Code Project Name		River Basin	Year 1	
Fox Run	Fox Run	Neuse	1432.587176	

Vigor

vigor	Count	Percent
0	19	3.8
1	26	5.2
2	110	22.1
3	234	47
4	97	19.5

Vigor by Species

Species	CommonName	4	3	2	1	0	Missing	Unknown
Betula nigra	river birch	6	14	3	1	2	2	
Celtis laevigata	sugarberry		9	4				
Nyssa biflora	swamp tupelo			2				
Nyssa sylvatica	blackgum	11	18	4				
Pinus taeda	loblolly pine	2	28	39	3	7	3	
Quercus michauxii	swamp chestnut oak	21	28	13	3	1	2	
Quercus nigra	water oak				1			
Quercus phellos	willow oak	14	51	10	2	1	1	
Sambucus								
canadensis	Common Elderberry	3	8	3	1	2		
Quercus	oak	2		3	1	2		
Quercus rubra	northern red oak	10	34	23	14	3	3	
Nyssa	tupelo		1					
Platanus occidentalis	American sycamore	22	20	1				
Ulmus americana	American elm	6	23	5			1	
Unknown						1		
15	14	97	234	110	26	19	12	

Damage

Damage						
Damage	Count	Percent Of Stems				
(no damage)	316	63.5				
Unknown	91	18.3				
Insects	44	8.8				
Diseased	28	5.6				
Deer	14	2.8				
Human Trampled	3	0.6				
Vine Strangulation	2	0.4				

Damage by Species

Species	CommonName	# Damage Categories	(no damage)	Unknown
Betula nigra	river birch	4	24	1
Celtis laevigata	sugarberry	6	7	2
Nyssa	tupelo	0	1	
Nyssa biflora	swamp tupelo	2		2
Nyssa sylvatica	blackgum	7	26	2
Pinus taeda	loblolly pine	47	35	1
Platanus occidentalis	American sycamore	5	38	
Quercus	oak	3	5	
Quercus michauxii	swamp chestnut oak	21	47	1
Quercus nigra	water oak	1		
Quercus phellos	willow oak	12	67	
Quercus rubra	northern red oak	60	27	2
Sambucus canadensis	Common Elderberry	4	13	
Ulmus americana	American elm	10	25	3
Unknown		0	1	
15	14	182	316	14

Damage by Plot

	Count of							
	Damage	(no			Human			Vine
plot	Categories	damage)	Deer	Diseased	Trampled	Insects	Unknown	Strangulation
1	5	13					5	
2	4	16		1			3	
3	2	19		2				
4	6	13		3		1	2	
5	4	17		2			2	
6	9	12					9	
7	14	11	2	1		1	10	
8	5	14		1		2	2	
9	11	10	1	3		2	5	
10	4	15		1			3	
11	8	16	3	2		3		
12	9	8	1	3	1	2	2	
13	4	17				2	2	
14	9	10		1		1	7	
15	9	10		1	1	2	5	
16	9	10					9	
17	7	9		3			3	1
18	4	11					4	
19	5	14					5	
20	10	6				8	2	
21	8	20				8		
22	9	9		1		4	3	1
23	6	14	2			2	2	
24	8	12	2	2		1	3	
25	13	10	3	1	1	5	3	
25	182	316	14	28	3	44	91	2

Plot Information

11011		natioi	.1										I	
Plot	Plot Level	Year	Planted Living Stems	Planted Living Stems EXCLUDING Live Stakes	Dead/Missing Stems	Natural (Volunteer) Stems	Total Living Stems	Total Living Stems EXCLUDING Live Stakes	Planted Living Stems per ACRE	Planted Living Stems EXCLUDING Live Stakes PER ACRE	Natural (Volunteer) Stems PER ACRE	Total Living Stems PER ACRE	Total Living Stems EXCLUDING Live Stakes PER ACRE	# species
1	2	1	17	17	1	0	17	17	688	688	0	688	688	7
2	2	1	19	19	1	0	19	19	769	769	0	769	769	7
3	2	1	20	20	1	1	21	21	809	809	40	850	850	6
4	2	1	17	17	2	3	20	20	688	688	121	809	809	6
5	2	1	21	21	0	0	21	21	850	850	0	850	850	5
6	2	1	15	15	6	0	15	15	607	607	0	607	607	7
7	2	1	23	23	2	0	23	23	931	931	0	931	931	5
8	2	1	17	17	2	11	28	28	688	688	445	1133	1133	5
9	2	1	18	18	3	0	18	18	728	728	0	728	728	7
10	2	1	19	19	0	30	49	49	769	769	1214	1983	1983	9
11	2	1	24	24	0	29	53	53	971	971	1174	2145	2145	6
12	2	1	17	17	0	199	216	216	688	688	8053	8741	8741	6
13	2	1	19	19	2	12	31	31	769	769	486	1255	1255	5
14	2	1	19	19	0	37	56	56	769	769	1497	2266	2266	5
15	2	1	18	18	1	26	44	44	728	728	1052	1781	1781	5
16	2	1	17	17	2	20	37	37	688	688	809	1497	1497	5
17	2	1	14	14	2	3	17	17	567	567	121	688	688	4
18	2	1	14	14	1	0	14	14	567	567	0	567	567	4
19	2	1	17	17	2	3	20	20	688	688	121	809	809	4
20	2	1	15	15	1	6	21	21	607	607	243	850	850	3
21	2	1	28	28	0	3	31	31	1133	1133	121	1255	1255	9
22	2	1	18	18	0	0	18	18	728	728	0	728	728	5
23	2	1	20	20	0	0	20	20	809	809	0	809	809	8
24	2	1	18	18	2	0	18	18	728	728	0	728	728	7
25	2	1	23	23	0	35	58	58	931	931	1416	2347	2347	6

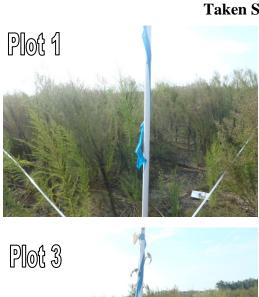
Planted Stems by Plot

			#																									
Species	Common Name	Stems	plots	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Betula nigra	river birch	24	8	3	1	3				2		6	4	3											4		1	1
Celtis laevigata	sugarberry	13	7	1.86		1			3						2				3					1				2
Nyssa	tupelo	1	1	1	1																							1
Nyssa biflora	swamp tupelo	2	1	2							2																	1
Nyssa sylvatica	blackgum	33	12	2.75	2		5	3	2			3		2		1									3	3	5	3
Pinus taeda	loblolly pine	72	23	3.13	4	2	4	4	2	3	4	1	3	1	3	3		1	3	3	5	3	4		5	1	5	3
Platanus occidentalis	American sycamore	43	15	2.87			1	1	1				1	1			3	4	9		2	4	4		3	4	2	3
Quercus	oak	6	5	1.2						1			2	1		1									1			
Quercus michauxii	swamp chestnut oak	65	19	3.42	2	1	1	4		2	7	3		4	5		4	3	2	1	4	6			6		1	3
Quercus nigra	water oak	1	1	1						1																		1
Quercus phellos	willow oak	77	18	4.28	5	8	6		13		8	4	1	2	3	2	5			4		1	5		1	5	3	
Quercus rubra	northern red oak	81	20	4.05	2	2		1		5	2		3		2	6	4	4	1	8	3		4	13	3	5	2	2
Sambucus canadensis	Common Elderberry	15	7	2.14		2	3							4										1	2		1	2
Ulmus americana	American elm	34	9	3.78				4		1			4	1	9	4	3	7		1								
14	14	467	14		17	19	20	17	21	15	23	17	18	19	24	17	19	19	18	17	14	14	17	15	28	18	20	18

Total Stems by Plot (Planted and Natural Recruits)

(Tranted and Tvaturar Recruits)			#																									
Species	Common Name	Stems	plots	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Acer rubrum	red maple	9	2	4.5												6					3							
Baccharis halimifolia	eastern baccharis	23	6	3.83			1					3				2			8					6				
Betula nigra	river birch	26	8	3.25	2	3				3		6	4	3											4		1	
Celtis laevigata	sugarberry	13	7	1.86		1			3						2				3					1				2
Liquidambar styraciflua	sweetgum	374	12	31.17				3				8		30	29	180	12	37	18	20			3		3			
Liriodendron tulipifera	tuliptree	10	1	10												10												
Nyssa	tupelo	1	1	1	1																							
Nyssa biflora	swamp tupelo	2	1	2							2																	
Nyssa sylvatica	blackgum	33	12	2.75	2		5	3	2			3		2		1									3	3	5	3
Pinus taeda	loblolly pine	81	24	3.38	4	3	4	5	2	4	4	2	3	1	3	4	2	1	3	3	6	3	4		5	1	5	3
Platanus occidentalis	American sycamore	43	15	2.87			1	1	1				1	1			3	4	9		2	4	4		3	4	2	3
Quercus	oak	8	6	1.33						1			3	1		1									1			1
Quercus michauxii	swamp chestnut oak	66	19	3.47	2	1	1	4		2	8	3		4	5		4	3	2	1	4	6			6		1	3
Quercus nigra	water oak	1	1	1						1																		
Quercus phellos	willow oak	78	18	4.33	5	8	6		13		8	4	1	2	3	2	5			5		1	5		1	5	3	
Quercus rubra	northern red oak	84	20	4.2	2	2		1		6	2		3		2	6	4	4	1	8	4		4	13	3	5	2	3
Sambucus canadensis	Common Elderberry	17	8	2.12		2	3						1	4										2	2		1	2
Ulmus americana	American elm	34	9	3.78				4		1			4	1	9	4	3	7		1								
Unknown		1	1	1																		1						
19	18	904	19		18	20	21	21	21	18	24	29	20	49	53	216	33	56	44	38	19	15	20	22	31	18	20	20

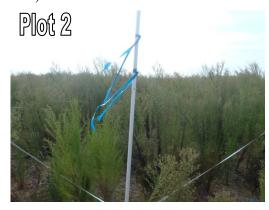
Fox Run Year 1 (2010) Vegetation Monitoring Plot Photos Taken September 16-17, 2010











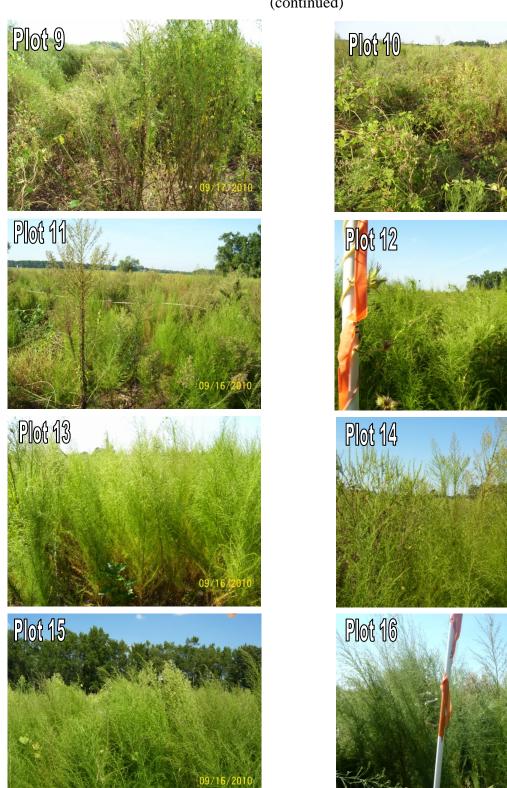






Fox Run **Year 1 (2010) Vegetation Monitoring Plot Photos Taken September 16-17, 2010**

(continued)



09/16/2010

Fox Run **Year 1 (2010) Vegetation Monitoring Plot Photos** Taken September 13, 2010 (continued)











Fox Run **Year 1 (2010)** Vegetation Monitoring Plot Photos Taken September 13, 2010 (continued)







