

**Fourth Annual Monitoring Report – 2006 Growing Season  
Moye Farm Riparian Buffer Restoration Project – Phase 1**

**P.O.# EP4045003 Contract AW0311-2**



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**Submitted to:**



**Guy Pearce  
North Carolina Ecosystem Enhancement  
Program  
2728 Capital Blvd., Suite 1H 103  
Raleigh, NC 27604**

**Submitted by:**

**Robert J. Goldstein and Associates, Inc.  
1221 Corporation Pkwy., Suite 100  
Raleigh, NC 27610**



**Submitted for:**



**Greene Environmental  
Services, LLC  
90 Ham Produce Road  
Snow Hill, NC 28580  
(252) 747-8200**

## **Introduction and Background**

In October 2002 the NC Wetlands Restoration Program (now the Ecosystem Enhancement Program) awarded Greene Environmental Services a contract to restore 37.1 acres of riparian buffer along an unnamed tributary to Contentnea Creek in southeastern Greene County, NC (Figure 1). The Moye Farm Riparian Buffer Restoration Plan (GES, 2003) was implemented in 2003 with site preparation, the planting of approximately 17,000 saplings of 18 species, and the establishment of permanent vegetation monitoring transects in accordance with the Plan.

Woody stem density monitoring was conducted in December 2003 along four 100 meter long permanent transects using the point-center-quarter method and in four co-located 0.25 acre permanent plots using total counts, as detailed in the Restoration Plan. The first year's woody stem density along the four 100-meter transects indicated an average density of 803 woody stems per acre of 15 species for the entire project. Plot data indicated 663 stems per acre in 2003. The second annual vegetation monitoring, conducted during November and December 2004, indicated 763 stems per acre along the transects and 741 stems per acre in the plots. The third annual vegetation monitoring, conducted during October 2005, indicated 1,150 woody stems per acre along the transects and 1,111 woody stems per acre in the plots (Table 1).

## **Results and Trends**

The fourth annual woody stem density monitoring was conducted in October 2006, also using the methodology detailed in the Restoration Plan. Density along the transects averaged 1,115 stems per acre; plot data averaged 1,143 stems per acre. **Both methods indicate that the project has exceeded its success criterion of 320 live woody stems per acre by more than two-fold for the fourth consecutive year.** This year's data are more than three times this minimum density (348%).

Permanent transect data indicate that *Quercus falcata* is the most abundant tree species recorded in 2006 (18.06 percent relative density). *Fraxinus pensylvanica* and *Liquidambar styraciflua* (12.26 percent), *Q. phellos* (11.61 percent), *Q. nigra* (10.63 percent), and *Q. michauxii* (8.39 percent) were the most dense species. Average sapling height along all transects was 183.95 centimeters (6.04 feet). *Prunus serotina* was the tallest species observed (518.17 cm (17.0 feet), only one individual was observed). *L. styraciflua* had the greatest average height in the restoration area (344.62 cm (11.31 feet)), followed by *Q. acutissima* (265.31 cm (8.7 feet)), *Q. phellos* (254.54 cm (8.35 feet)), *Q. nigra* (252.76 cm (8.29 feet)), and *Q. laurifolia* (250.96 cm (8.23 feet)) (Table 2).

Based on transect data, overall woody stem density decreased by 3.1 percent from 2005. This decrease in density was probably due to mortality of very small sprouts in tract A. Average height increased by 198 percent from 2005, and 284 percent from 2004 (82.10 cm (2.69 feet) in 2004, 92.78 cm (3.04 feet) in 2005, and 183.95 cm (6.04 feet) in 2006).

The point centered quarter method used at each permanent plot takes four samples at 10 random points along the 100-meter transect. This method is used to measure absolute density throughout the sampling area. Relative density and dominance throughout the restoration area are not necessarily defined by a single year's data.

## **Maintenance (completed and planned) and Anecdotal Observations**

The Phase 1 restoration project is maturing and no negatively impacted areas were observed (qualitatively or quantitatively). As a result no additional silt fences, rip-rap, or other erosion control materials were installed during 2006. Similarly, no container stock or bare root seedlings were

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installed anywhere within the Phase 1 area. Erosion control measures and remedial plantings installed during 2004 seemed to have been effective. Spot application of herbicide (Roundup) was done in selected areas in May 2006. In a few areas where weedy vegetation was too robust to respond to the herbicide application, selective manual weed removal was done using machetes and gasoline-powered string trimmers.

Like in 2004, browsing evidence was observed in all tracts. Deer prints were observed in the soil near many trees with obvious branch tip browsing. While damage to branch tips may have affected overall height, it did not seem to result in mortality. Rodent browsing at the base of the trees' main stems seemed to decrease since 2004. No serious browsing impacts were observed and no trees were observed to have been killed from browsing.

Overall, all tracts seem to be maturing nicely. The trees nearest to the streams and in the wetter pockets are beginning to dominate the weedy thickets. An immature canopy has begun to form in some areas. As the monitoring data indicate, sapling survival is high and no remedial planting, or other action will therefore be necessary.

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**Table 1. Woody stem density and trends - Moye Farm Riparian Buffer Restoration Project - Phase 1, October 2006.**

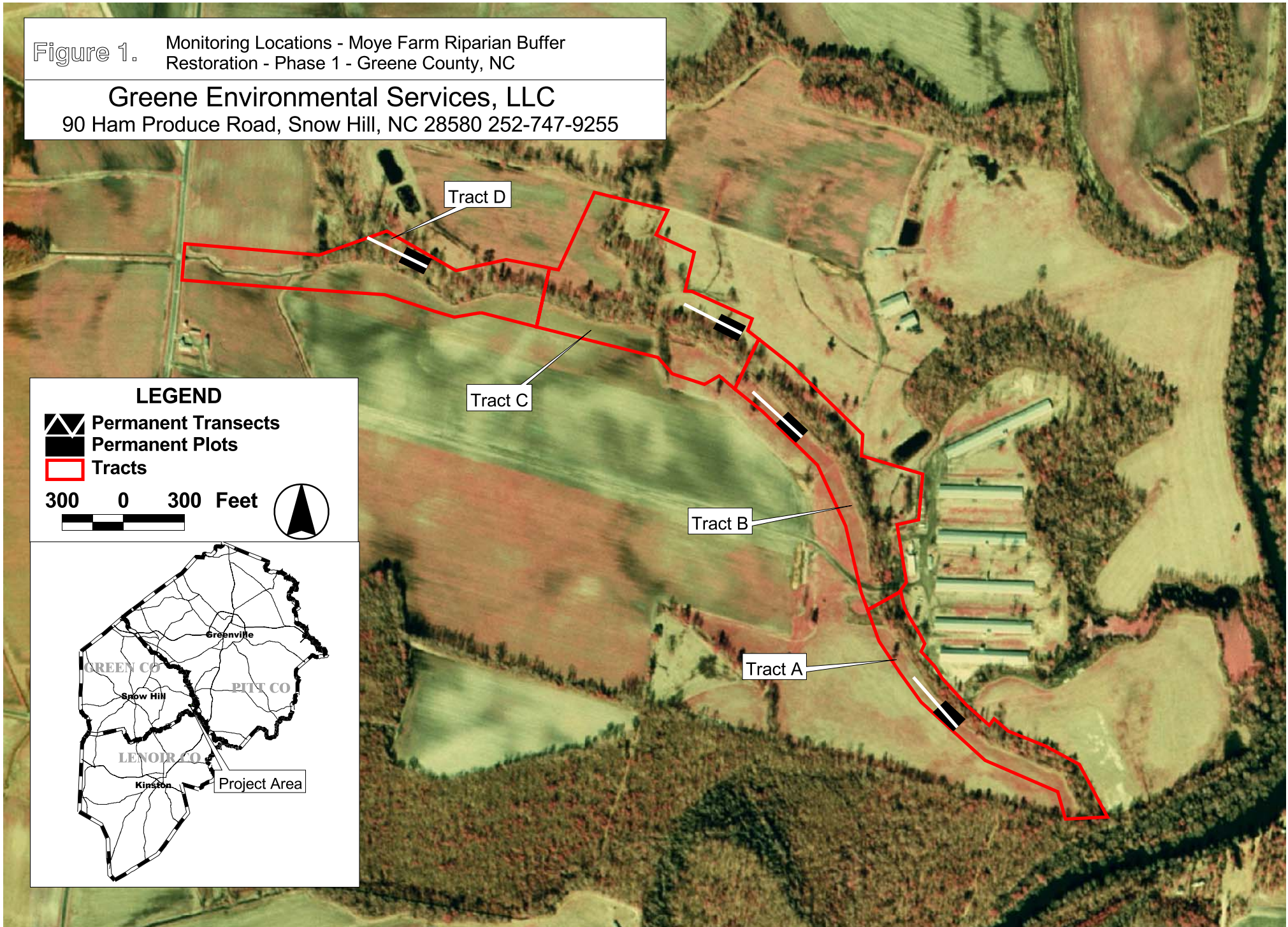
Tract	-----0.25 acre plot-----								permanent transects			
	number live stems				live stems/acre				average live stems/acre			
	2003	2004	2005	2006	2003	2004	2005	2006	2003	2004	2005	2006
A	187	229	249	152	748	916	996	607	621	544	719.2866	639
B	150	155	229	233	600	620	916	931	829	844	948.3889	1,256
C	145	145	157	177	580	580	628	708	858	705	1376.681	1,293
D	181	212	476	582	724	848	1904	2327	904	961	1556.295	1,271
<b>Average (all tracts)</b>	<b>166</b>	<b>185</b>	<b>278</b>	<b>286</b>	<b>663</b>	<b>741</b>	<b>1,111</b>	<b>1,143</b>	<b>803</b>	<b>764</b>	<b>1,150</b>	<b>1,115</b>

**Table 2. Relative density and average height of woody stems from permanent transects - Moye Farm Riparian Buffer Restoration Project Phase 1, October 2006.**

Species	Total (Tract)				Total (All Tracts)	Relative Density (%)	Height cm	DDH/DBH mm
	A	B	C	D				
<i>Acer rubra</i>		2	1		3	1.94	45.57	27.25
<i>Celtis laeviagata</i>		1	1		2	1.29	50.29	3.85
<i>Fraxinus pennsylvanica</i>		3	12	4	19	12.26	94.09	6.87
<i>Liquidambar styraciflua</i>	2	3	4	10	19	12.26	344.62	2.80
<i>Liriodendron tulipifera</i>	1				1	0.65	192.03	1.50
<i>Platanus occidentalis</i>		4			4	2.58	81.15	0.65
<i>Prunus serotina</i>				1	1	0.65	518.17	6.00
<i>Quercus acutissima</i>	6	3	2	3	14	9.03	265.31	4.41
<i>Quercus alba</i>	1	1	1		3	1.94	71.32	4.80
<i>Quercus falcata</i>	10	5	13		28	18.06	192.91	3.12
<i>Quercus laurifolia</i>	1	5	1		7	4.52	250.96	0.84
<i>Quercus lyrata</i>	0	2		1	3	1.94	234.70	2.60
<i>Quercus michauxii</i>	9			4	13	8.39	114.71	4.03
<i>Quercus nigra</i>	2	8		5	15	9.68	252.76	4.44
<i>Quercus pagodaefolia</i>								
<i>Quercus phellos</i>	7	1	4	6	18	11.61	254.51	6.27
<i>Quercus rubra</i>	1	1		2	4	2.58	66.55	1.05
<i>Taxodium distichum</i>			1	0	1	0.65	97.54	34.00
<b>Total</b>	<b>40</b>	<b>39</b>	<b>40</b>	<b>36</b>	<b>155</b>	<b>100.00</b>	<b>183.95</b>	<b>6.73</b>
<b>Average Stems/acre</b>	<b>639</b>	<b>1,256</b>	<b>1,897</b>	<b>1,293</b>	<b>1,271</b>			

Figure 1. Monitoring Locations - Moye Farm Riparian Buffer Restoration - Phase 1 - Greene County, NC

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**Permanent Transect Photographs - Moye Farm Riparian Buffer Restoration Project Phase 1**



**Tract A 2005**



**Tract A 2006**



**Tract B 2005**



**Tract B 2006**

**Permanent Transect Photographs - Moye Farm Riparian Buffer Restoration Project Phase 1**



**Tract C 2005**



**Tract C 2006**



**Tract D 2005**



**Tract D 2006**