

Combating Invasive Species:

Response of a Suburban Bottomland / Levee Forest to Removal of Invasive Plants

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Invasive Species

- Nonnative organisms that spread rapidly and cause harm
- ~4900 nonnative species in U.S. USDA
- Yearly economic impact (US)
100-140 billion dollars
- Second largest environmental problem

Selection of Study Site

- 1. Abundance of invasive species
- 2. Owner interested in removal of Invasives
- 3. Proximity to Wofford College



Edwin M. Griffin Nature Preserve (Cottonwood Trail)

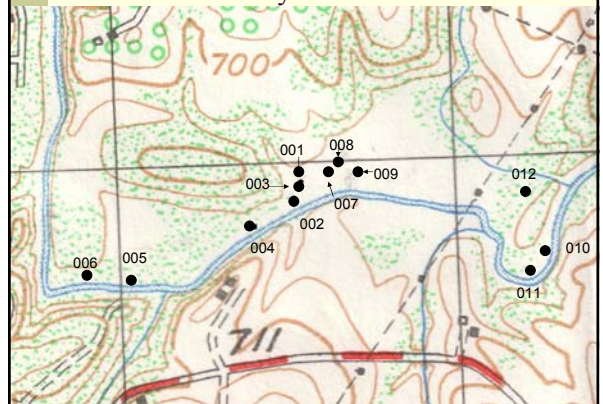
- 85 acres
- SPACE (The Spartanburg Area Conservancy)
- Lawson Fork Creek
- Bottomland Hardwood/Levee Forest

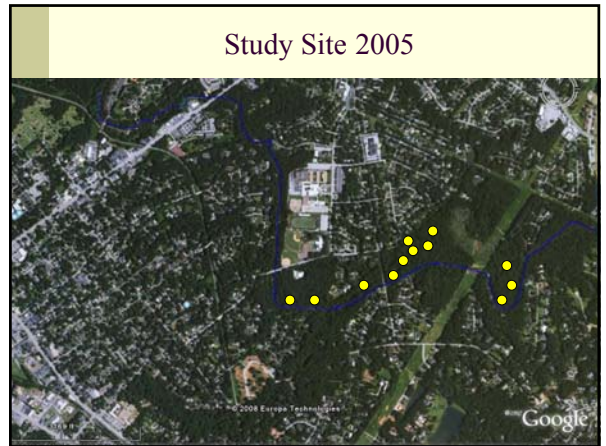
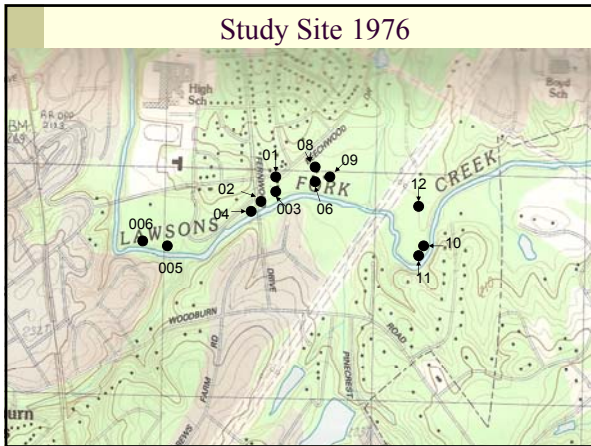


Study Site 1938



Study Site 1947





Results of 2004 Invasive Species Survey - Edwin Griffin Preserve

- Chinese Privet 83%
- Honeysuckle 72%
- English Ivy 36%

# of Invasive Species in Plot	# of Plots	% with at Least
0	1	1
1	18	99
2	38	81
3	30	43
4	13	13

Abundant Invasive Species

- Herbs:
 - Japanese Honeysuckle
 - Kudzu
 - English Ivy
- Shrubs:
 - Chinese Privet
 - Multiflora Rose
 - Nandina
- Trees:
 - Privet-
 - Most dominant
 - Visible effect on diversity



Chinese Privet (*Ligustrum sinense*)

- Introduced for Landscaping
- Rapid Spread
- Insect Resistant
- Light & Shade Tolerant
- Favors Moist Zones
- Focus of our Plot Selection




Hypothesis

- Dense cover of privet reduces species diversity
- Removal of privet will:
 - Increase species diversity
 - Increase diversity of species preferring bottomland/levee forests

Plot Selection

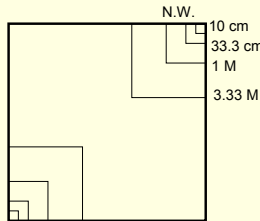
- Locate areas of dense and sparse privet cover across preserve
- Mark off 10 x 10 meter permanent plots
 - 6 Dense Plots
 - 6 Sparse Plots
 - 4 Control Plots



Vegetation Survey

(North Carolina Vegetation Survey Protocol)

- Trees, Shrubs, Herbs Surveyed Separately
- Logarithmic series of subplots in each 10 x 10 m plot

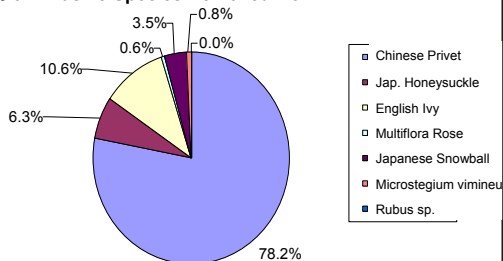


Removal of Selected Invasives from Experimental Plots



Dominant Invasives by Weight

% of Invasive Species Removed from All PI



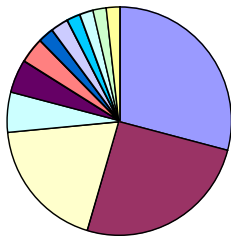
Plot Characterization

- Plots actually fall into Dense, Medium, and Sparse Privet cover

Ave Weight Removed (kg)	Ave Cover of Privet
Dense 661.7	75-100 %
Medium 247.3	42-67 %
Sparse 86.3	7-17 %



Dominant Canopy Species

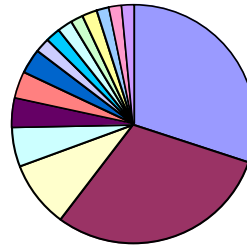


- Red Ash
- Box Elder
- Sugar Berry
- Water Oak
- Sycamore
- Bitternut Hickory
- Flowering Dogwood
- Black Cherry
- Sweetgum
- River Birch

Relative Frequency
Relative Density
Relative Dominance

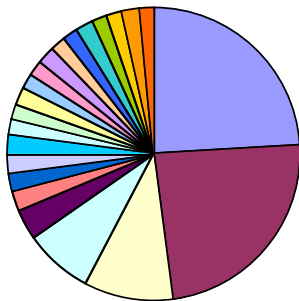
$Species\ Importance = F + D + Do$

Dominant Species in Herbaceous Layer Dense & Medium Experimental Plots 2004



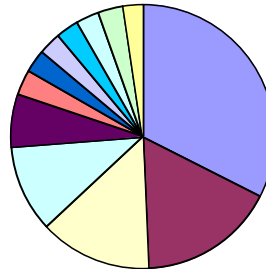
- English Ivy
- Japanese Honeysuckle
- Chinese Privet
- Cross Vine
- Blue Violet
- Glecoma
- Multiflora Rose
- Bursting Hearts
- Viburnum
- Tulip Poplar
- Bed Straw
- Muscadine
- Ophiopogon
- Common Chickweed
- Box Elder

Dominant Species in Herbaceous Layer Dense & Medium Experimental Plots 2007



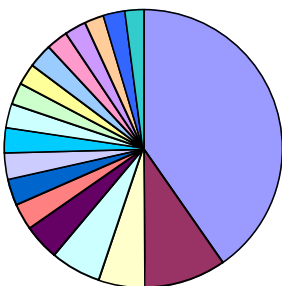
- Microstegium
- American Pokeweed
- Sand Violet
- Box Elder
- Japanese Honeysuckle
- Woodland Sunflower
- Broadwinged Sedge
- Switch Cane
- Red Ash
- Sugar Berry
- Chinese Yam
- Chinese Privet

Dominant Species in Herbaceous Layer Sparse Experimental Plots 2004



- Microstegium
- English Ivy
- Japanese Honeysuckle
- American Pokeweed
- Chinese Privet
- Bed Straw
- Box Elder
- Sedge
- Red Ash
- Glecoma
- Sheezweed
- Knotweed

Dominant Species in Herbaceous Layer Sparse Experimental Plots 2007



- Microstegium
- Box Elder
- American Pokeweed
- Japanese Honeysuckle
- Glecoma
- Broadwinged Sedge
- Bluegrass
- Sweet Woodreed
- Red Ash
- False Nettle
- Bitternut Hickory
- English Ivy
- Threeway Sedge
- White Avens
- Jumpseed
- Sugar Berry
- Chinese Yam

Species Richness: Experimental Plots 2004 vs. 2007

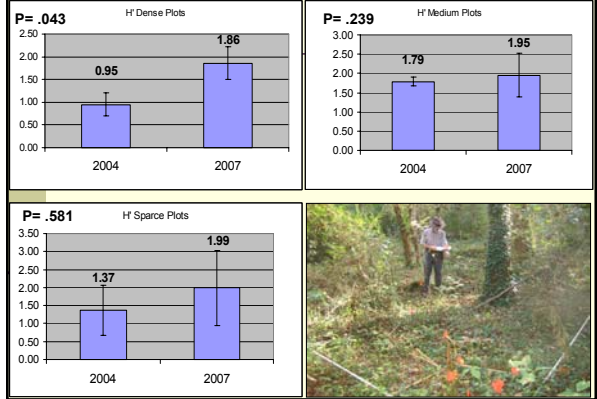
	Plot Number	# Species 04	# Species 07	Percent Change	
Dense	1	10	48	480	
	8	10	35	350	
	10	10	46	460	
	(Control)	3	3	14	467
Medium	4	16	46	288	
	11	15	30	200	
	(Control)	6	22	22	100
	(Control)	6	22	22	100
Sparse	2	27	35	130	
	7	19	26	137	
	12	19	33	174	
	(Control)	5	12	34	283
	(Control)	9	15	31	207

Shannon's Index of Diversity

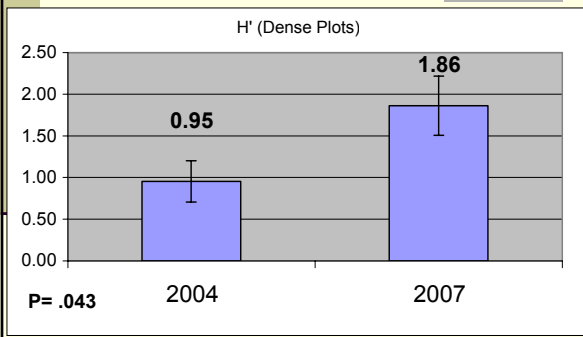
$$H^1 = -\sum [P_i \times \ln(P_i)]$$

$P_i = \frac{\text{Percent Cover}}{100}$

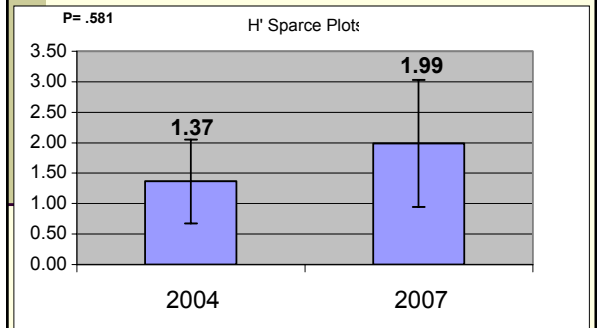
Shannon's Diversity- Experimental Plots



Shannon's Diversity: Dense Plots



Shannon's Diversity: Dense Plots

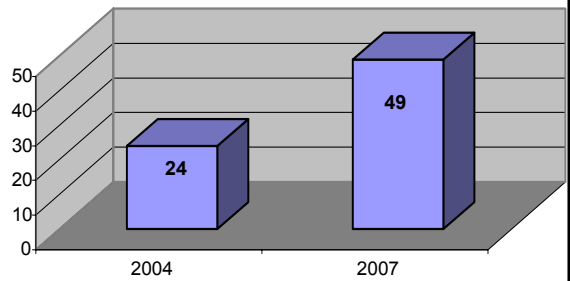


Shannon's Diversity: Controls

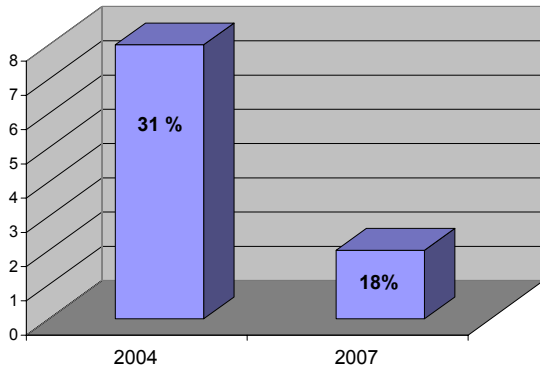


Recruitment of Native Bottomland Species

Species Native to Bottomland F



Decline in Nonnative Species



Conclusions

- Dense infestations of privet reduce species diversity
- Removal of dense cover of privet allows for significant increase in species diversity
- Removal of medium to sparse infestations of privet may increase species diversity
- A bank of native species is available that can become established following the removal of dense infestations of privet

Additional Conclusions

- Weedy and non-native species continued to dominate the ground and shrub layers in all plots (Experimental and Control)

Privet Pokeweed Microstegium



Take Home Message

- Millions of acres across S.E. infested with Privet
- Removal of Privet allows a natural recovery of native species
- Removal protocols being developed
- But... Microstegium now a problem

Acknowledgements

- The Spartanburg Area Conservancy
- Volunteers

Past studies info

- Urban development increases invasive species richness in S.E. (*Loewenstein and Loewenstein 2005*)
- Removal of privet shown to increase species diversity (*Merriam & Feil 2003*)
- Privet capable of withstanding short-term flooding (*Brown & Pezeshki 2000*)

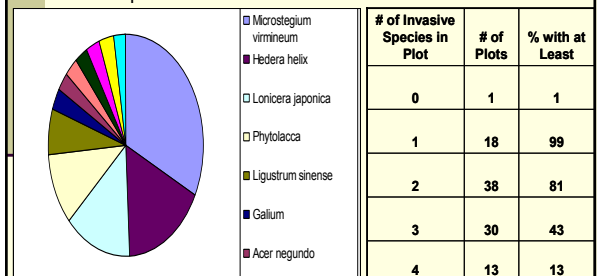
Health of Cottonwood's Ecosystem

- Naturally a levee & bottomland forest
- Healthy Canopy
- Herbaceous level infested with invasive species



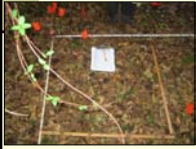
Greene's Original Survey

- Importance Values from all 12 plots
- 100 plots



Fall 2007 survey

- 12 plots 10 x 10 meters
- 3 Dense, 2 Med, 3 Sparse Exp Plots- Invasives cut and killed
 - *L. sinense* ■ *Hedera helix*
 - *Lon. japonica* ■ *Rosa multiflora*
- 1 Control for each



Invasive species in South Carolina

- USFS survey Inventory and Analysis-
- 40 % of plots studied contained at least one invasive species
- More non native in Piedmont
- 11% contained Ligustrum genera



*Oswalt, Sonja. Nonnative Invasive Plants in South Carolina: Combining Phase-2 with Phase-3 Vegetation Structure and Diversity Pilot Data to Enhance our Understanding of Forest Health Issues. 2004

Recruitment of Native Bottomland Species

- Greater recruitment of native bottomland and native non-weedy species
- ↑ # species that prefer bottomland forest habitat:
- ↓ # of nonnative species

