Using the past to restore the future: Quantifying historical vegetation to assist in tidal freshwater wetland restoration

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Former Lake Charles at the VCU Rice Rivers Center

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Background

Wetlands have been providing humans with critical natural ecosystem services throughout our time on Earth. Nevertheless, these invaluable ecosystems have been habitually altered as a cost of human progression. Two of the most common alterations to wetlands are hydrologic, in the form of damming, and filling. Both occurred along Kimages Creek in Charles City County, VA during the 19th and 20th centuries. In 2010 the Lake Charles dam was partially removed, restoring the creek's tidal communication with the James River and beginning tidal forested freshwater wetland restoration. Upon the recession of the body of water, numerous woody stumps were revealed.

Objectives:

We studied these stump remnants in an attempt to assess the spatial structure and vegetative community of this forested freshwater tidal wetland before perturbation.

Picture of the Kimages Creek wetland under Union occupation during the Civil War (Egghart 2009)

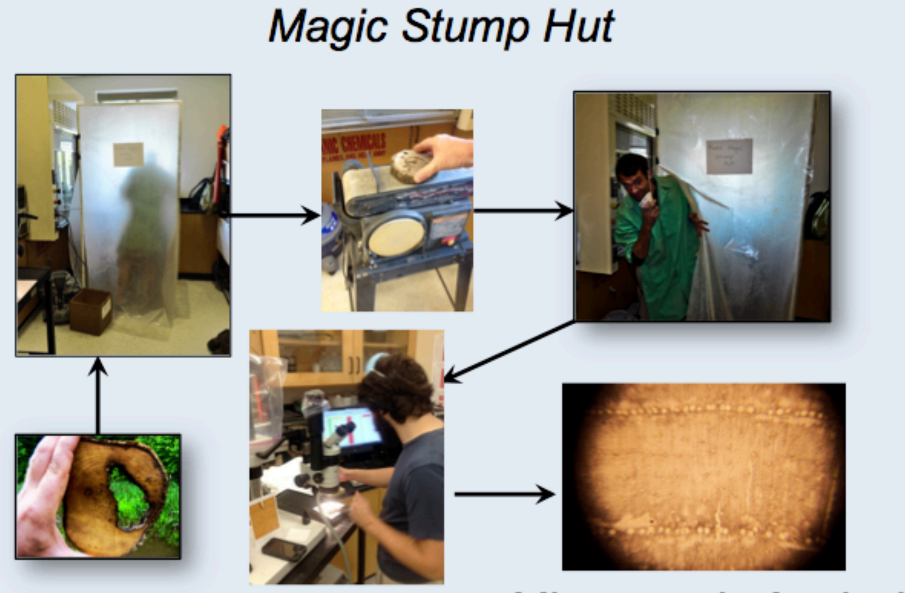
Present day photo of the Kimages Creek wetland. Photo credit: Rick Ward

Methods

1) We began by obtaining the geospatial location of each discovered stump with a handheld GPS unit. Every 10 stumps we took a cross-sectional wood sample using a handsaw (a stump "cookie").

2) In the lab we first sanded the stumps for easier microscopic analysis. We then used microscopy and a Taxonomic Identification Code process. This process yields a unique alphanumeric code (a TIC), each of which corresponds to a certain species or genus of tree.

"Cookie" Processing & Analyses

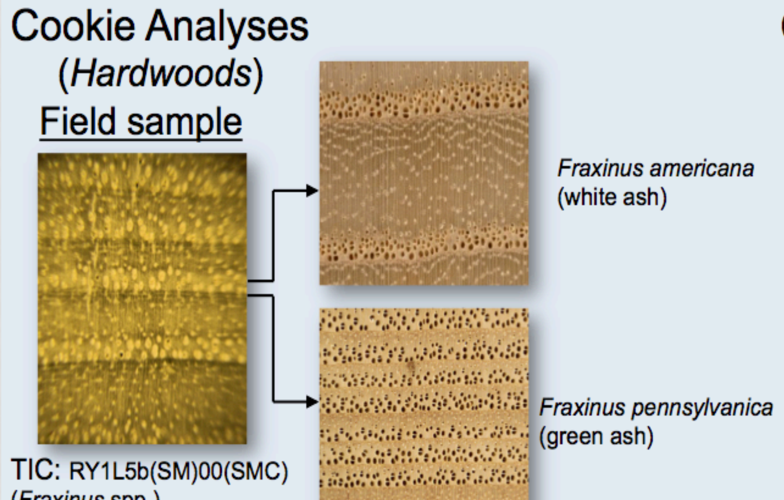


3) The Taxonomic Identification Process

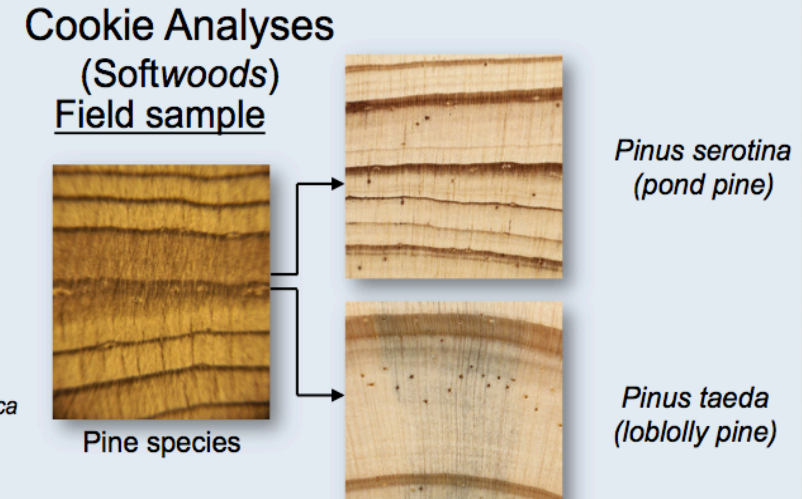
	Diagnostic characteristics	TIC
[1]Step 1	Ring-porous	R
	Semi-ring-porous	S
	Diffuse-porous	D
[1]Step 2	Visible (≤10X) growth rings	Y
	Microscopic (>10X) growth rings	N
[2]Step 3	Uniseriate rays	1
	Multiseriate rays	2
[1]Step 4	Distinct uniseriate rays (<10X)	E
	Indistinct uniseriate rays (=10X)	L
	Microscopic uniseriate rays (>10X)	M
Earlywood Diagnostics		
[1]Step 5	Miniscule pores, single row, intermittently spaced	1
	Small pores, 2 to 4 pores wide, adjacently arranged	2
	Large pores, 1 – 2 pores wide, intermittently spaced	3
	Large pores, 1 – 2 pores wide, adjacently arranged	4
	Large pores, 2 – 4 pores wide, adjacently arranged	5a
	Large pores, 2 – 4 pores wide, intermittently spaced	5b
	Large pores, 3 – 8 pores in width	6
[1]Step 6	Solitary pores	S
	Multiple pores	M

Latewood Diagnostics		TIC
[1]Step 7	Width between uniseriate rays > average latewood pore width	G
	Width between uniseriate rays = average latewood pore width	E
	Width between uniseriate rays < average latewood pore width	L
[1]Step 8	Even distribution	1
	Uneven distribution	2
[2]Step 9	Solitary pores	S
	Multiple pores	M
	Chain pores	C
	Nested pores	N
	Wavy pores (ulmiform)	W
[1]Step 10	Continuous "lines" run parallel to growth rings connecting pores and uniseriate rays	3
	Intermittent horizontal/wavy lines connecting latewood pores	4
	Two previous characteristics are absent	5
[1]Step 11	Growth rings are defined by a continuous "line" of pores	P
	Growth rings are definable bands of parenchyma cells	L
	Growth rings are neither comprised of pores or definable bands of parenchyma cells	O

Cookie Analyses (*Hardwoods*)



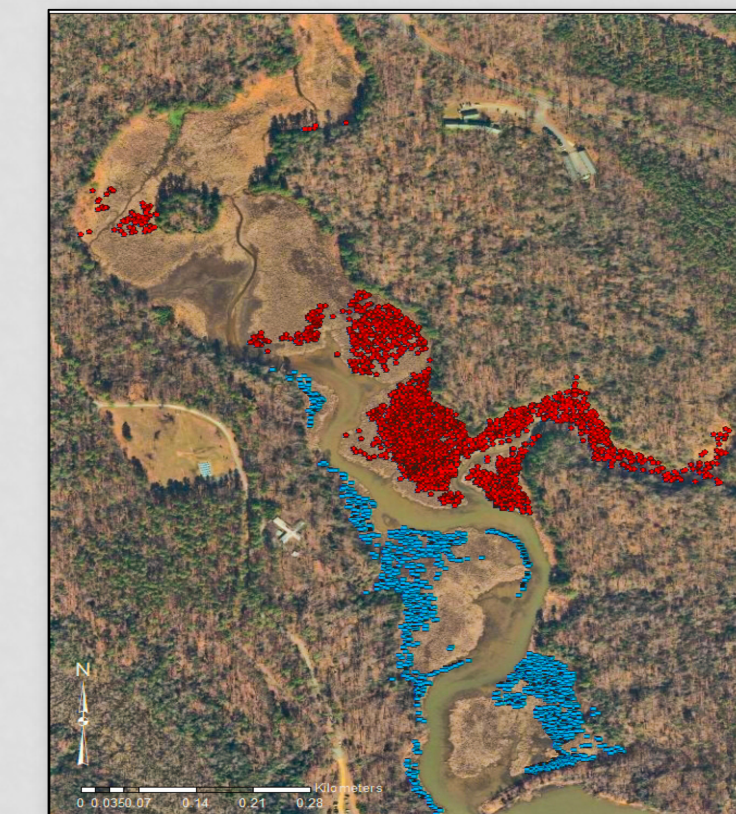
Cookie Analyses (Soft*woods*)



Results/Discussion

During this ongoing study, over 4,500 stumps have been geo-located and 413 samples have been processed. There were 11 unique genera identified, among which 15 were identified to the species. The most abundant genus of trees was *Fraxinus* spp. with a relative density of 73.24%, and the next most abundant was *Carya* spp. with a relative density of 11.79%. The remaining samples were comprised of small densities of various species. The majority of the samples were of obligate or facultative wetland species (63.1%).

We will soon compile the geospatial coordinates onto a GIS map and use the species data to better understand the native community. Recreating the natural historical vegetative community could help guide current restoration efforts in other locations in other mid-Atlantic formally impounded wetlands. Ultimately our goal is to be able to build a functioning virtual wetland model.



Geospatial Points:
n~=4,546

Stump "cookies":
413 total
258 identified
156 age-identified

Historical Forest Analysis (to date):
11 genera; 15 species
Most abundant: Fraxinus spp. (RD=73%)
Age range: 10-102 yr

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