Sediment Quality in BMPs

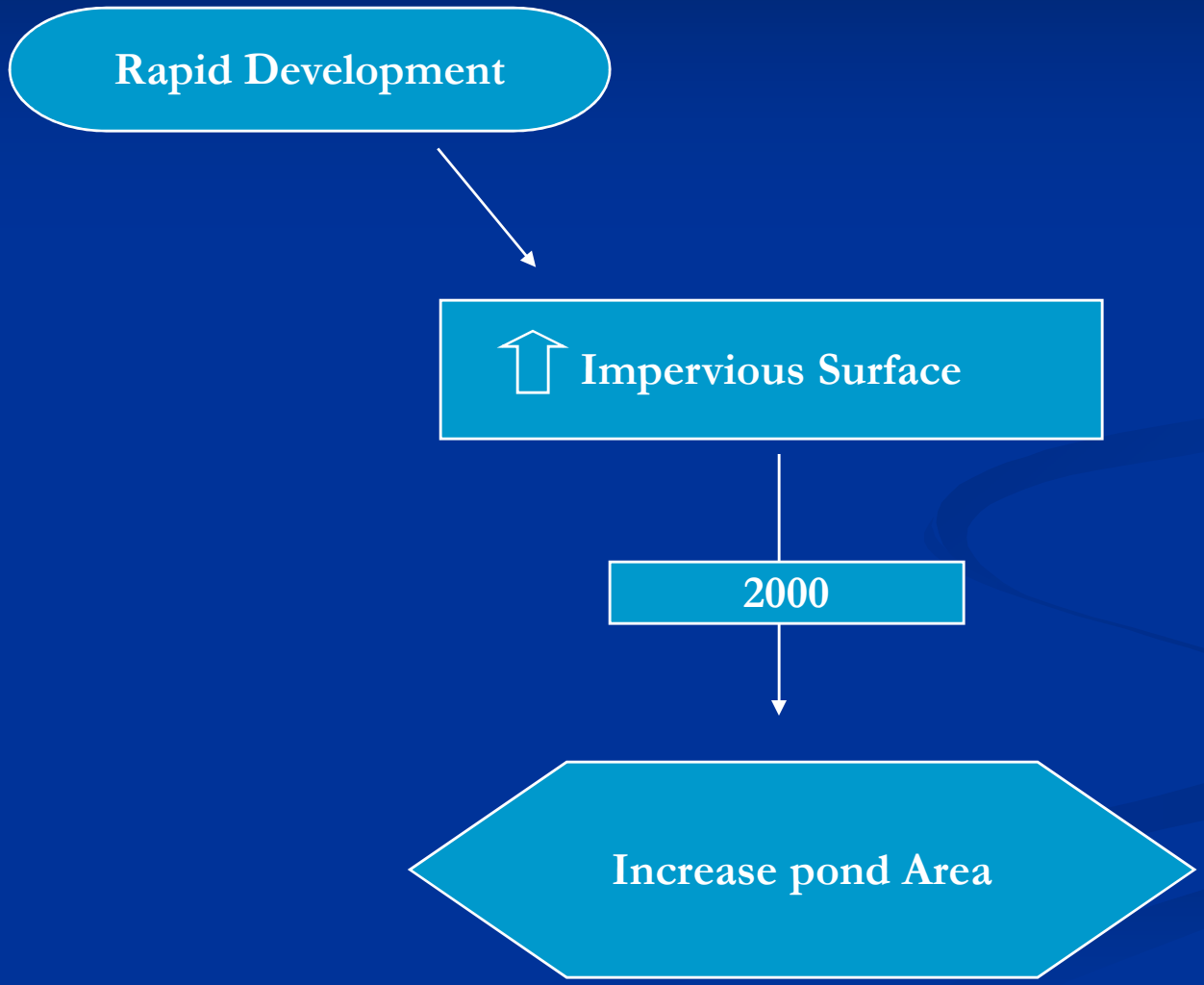
Amanda Vandermark, St. John Fisher College

Advisor: Dr. Randy Chambers, REU 2007

Overview

- Brief Background
  - Significance of the Study
- Big Question
  - Hypothesis
- Methods/Sample Size
- Sediment Sample Analysis
- Results
- Conclusions
- Questions for Further Research

Background


Rapid Development
Impervious Surface
2000
Increase pond Area

Big Question

- How does the environment in which a retention pond is built affect the sediment chemistry?

Impacting Factors:

Impervious Surface

Pond Area

Runoff Area

Pond Age

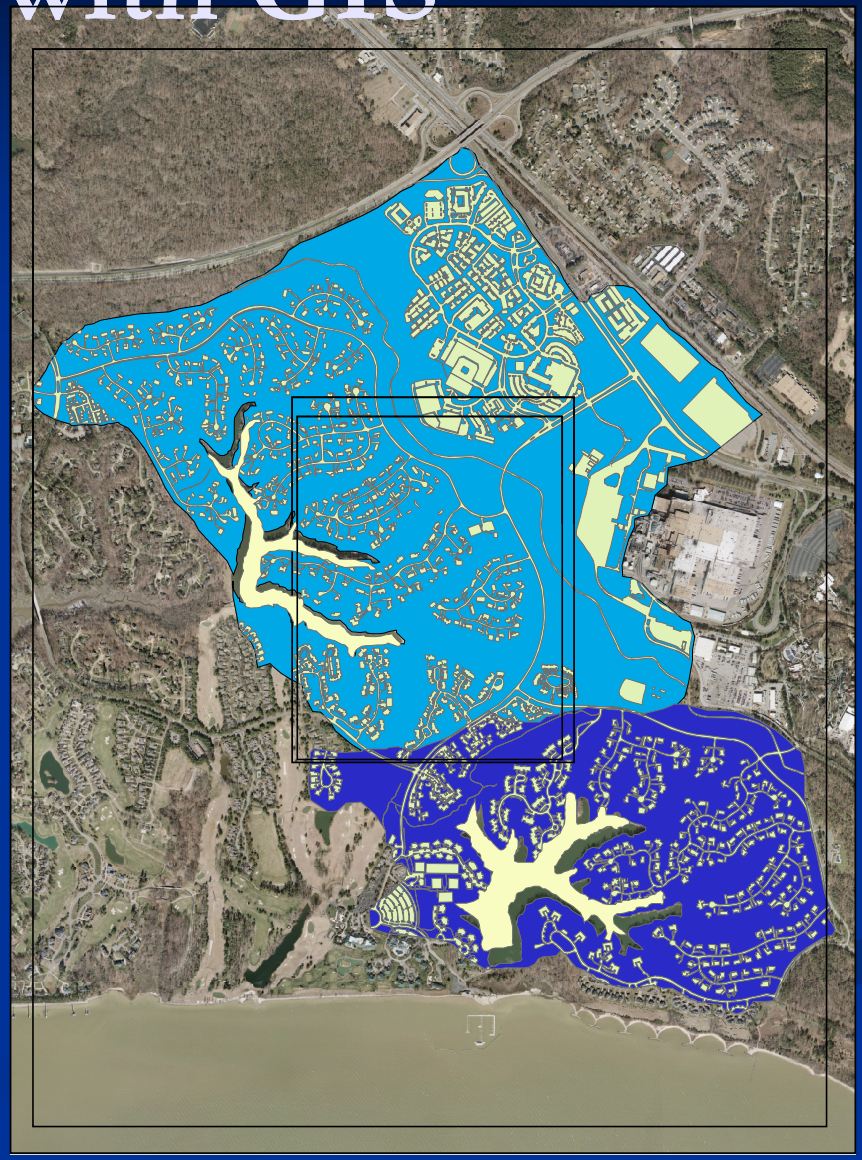
Original Hypothesis

- As the amount of impervious surface increases, nutrient runoff increases resulting in higher levels

of biogenic silica and algal activity found at BMPs.

Digitizing with GIS

- Pond Area
- Runoff Area
- Impervious Surface



Distribution of Pond Selection

Date Constructed	Age	Sample Size	Classification
2007-2000	1 - 7yrs	12	Young Ponds
1999-1996	8-12yrs	4	Middle Ponds
1996-1987	13-19yrs	9	Old Ponds
<1987	20+	5	Omitted Ponds

%Impervious		
0-10%	1	
10-15%	3	Sensitive Streams
15-25%	12	Impacted Streams
25-40%	8	Non-Supportive Streams
40-60%	5	
60-100%	1	

Sample Size

- 30 classified wet ponds

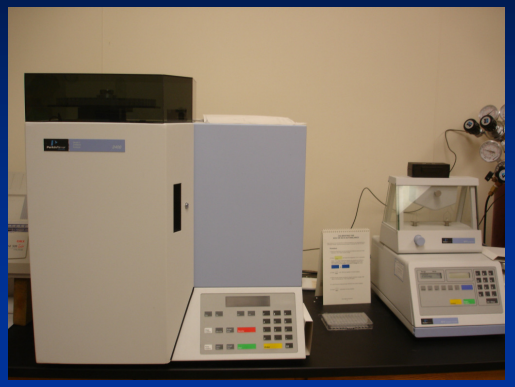
3 samples from each outlet

top 2cm of sediment measured with the calibrated corer

Analysis

- C:N Ratio

Elemental Analyzer



- Silica Extraction and Analysis

modification of DeMaster (1981)

- Phosphorus Test

Phosphate Analysis Protocol

- Organic Matter

As loss on ignition

Results

Nutrient Ranges

Element	Low	High
%P	0.00034	0.01999
%N	0.00	1.23
%H	0.04	2.31
%C	0.17	16.26
%BSi	0.093	0.143
%O.M	0.87	36.93

C : N : P

106 : 16 : 1 Redfield's Ratio for Algae

1195 : 57 : 1 My Found Ratio

*More carbon per mole of nitrogen.
Possible reason for such a high level of carbon is due to the leaf litter, plants, and woody materials on the floor of the ponds.

Principal Components Analysis

Component Matrix[a]

	Component	
	1	2
Pond_Age	.127	-.807
Pond_Area_ squaremeters	.933	.041
impervious_percentage	-.288	.635
Runoff_Area_ squaremeters	.907	.272

Extraction Method: Principal Component Analysis.

a. 2 components extracted.

Component 1- Surface Area of the Ponds
Component 2- Age in Relation to Impervious Cover

Component Matrix[a]

	Component	
	1	2
AVG_OrganicMatter_ Percentage	.956	-.010
AVG_Carbon_percentage	.912	-.043
AVG_Nitrogen_ percentage	.939	-.124
AVG_Phosphorus_ percentage	.721	.402
AVG_BSi_percentage	-.131	.954

Extraction Method: Principal Component Analysis.

a. 2 components extracted.

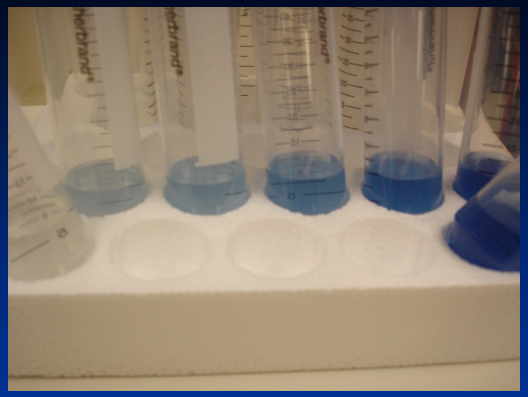
Component 1- Organic Matter and Terrestrial Material
Component 2- Biogenic Silica

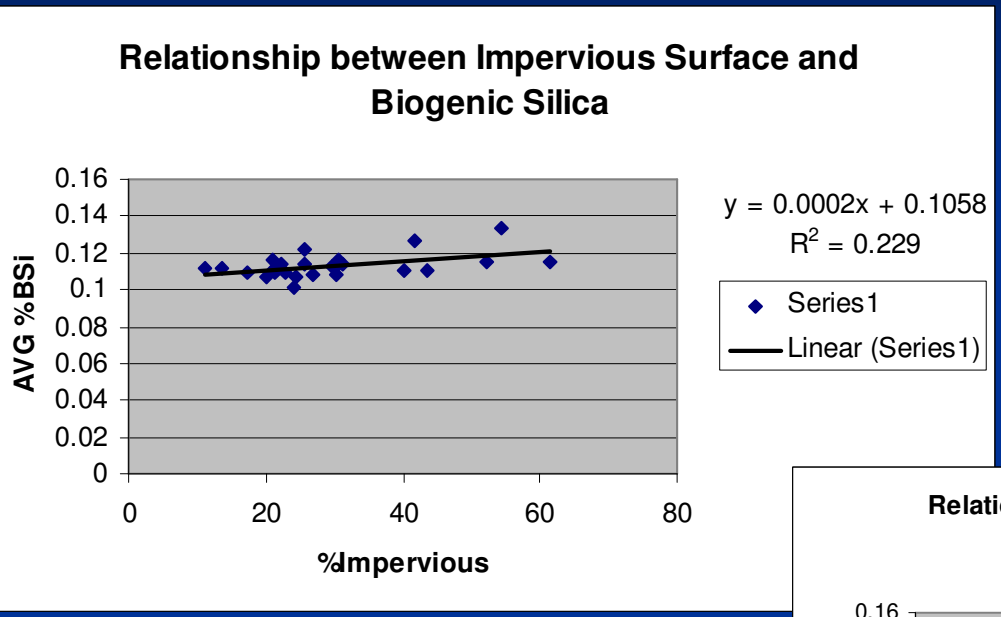
Correlations

		LargerPonds_ increasedRO	Younger Ponds_ increased Impervious
Nutrients	Pearson Correlation	-.040	-.058
	Sig. (2-tailed)	.851	.784
	N	25	25
BSi_increase_CN. OM.decrease	Pearson Correlation	-.197	.699**
	Sig. (2-tailed)	.344	.000
	N	25	25

**. Correlation is significant at the 0.01 level (2-tailed).

Results



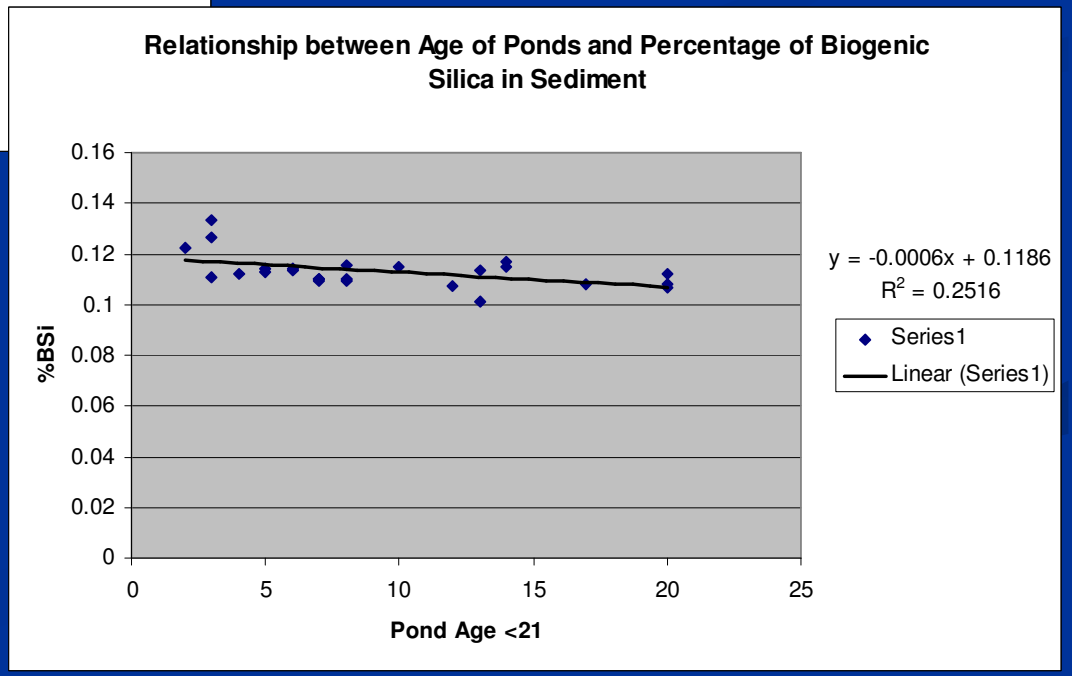


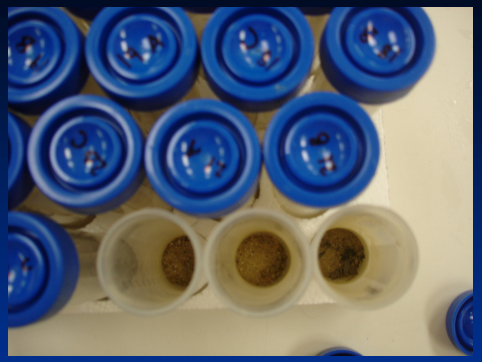
P-value

Significance
0.015519

P-value

Significance
0.010692





Conclusion

- Even in ponds where there were obvious signs of nutrient runoff, levels of nitrogen and phosphorus were consistently low.

- Although a wide range of BSi concentrations weren't found across the sampled ponds, trends showed that younger ponds with the most impervious cover had the highest percentage of BSi in the sediment.

Questions for Further Study

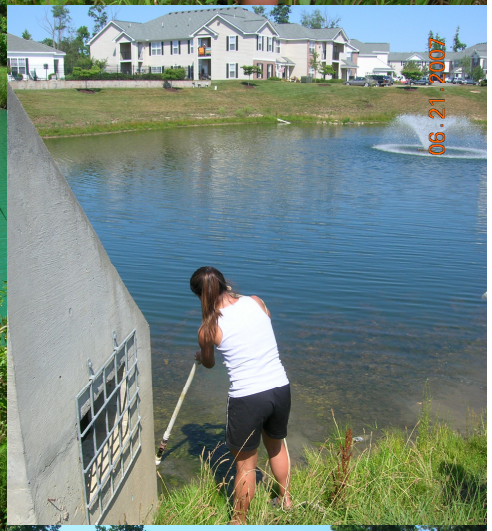
- What are the BSi percentages of sediment downstream of the retention ponds?
- How would the results change if more variables were kept constant?


06.26.2007


06.20.2007


06.21.2007


06.20.2007


06.21.2007


06.27.2007


06.21.2007


06.20.2007