Predicting environmental conditions using GIS:

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What is GIS?

* Geographic Information Systems (GIS) is a new and rapidly growing field. Many business and governments are adopting GIS to target their markets and clients, and monitor and manage their own activities.

* As a field of study, geography is going through a

"re-birth". It is once again becoming a serious discipline, thanks in part to the linkage of Geographic Information Systems (GIS).

Educational Benefits of GIS
## "Not just for geographers anymore…"

- GIS is a cross-disciplinary tool that is found in the classrooms of many academic departments.
  - Architecture
  - Natural Resource Management
  - Business
  - Natural Sciences
  - Public Heath and Medicine
  - Humanities
  - Physical Sciences
  - Engineering
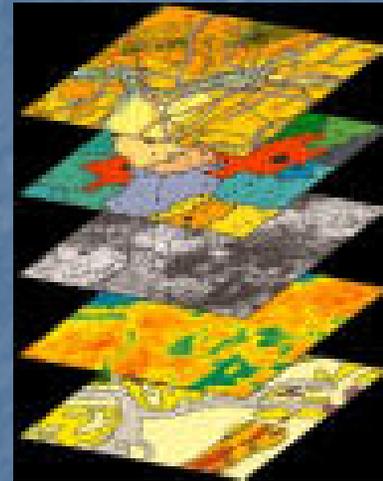
Benefits of GIS to Education

- Working with GIS has <u>many</u> benefits in a secondary classroom. GIS helps...
  - Develop computer literacy
  - Analytical approaches to problem solving
 - Communication and presentation skills
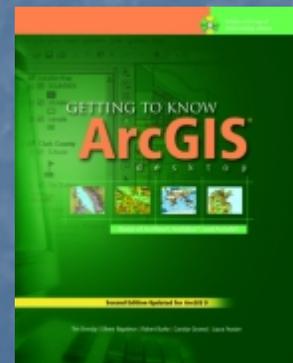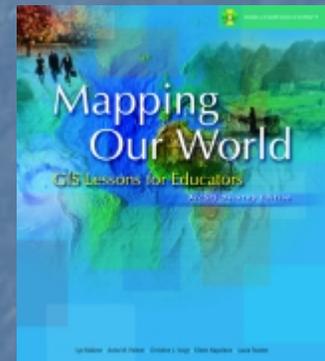
Project-"Predicting Environmental Conditions using GIS"

- This particular project was made possible by the National Science Foundation and took place at the Lodge Lab and the Center for Aquatic Conservation and the University of Notre Dame. (aquacon.nd.edu)

- The study area was a portion of the Northern Highlands Lake District of Wisconsin and the Upper Peninsula of Michigan.

- The investigation used <u>interpolation</u> techniques for predicting abiotic environmental conditions in unsampled lakes based on adequately sampled lakes

Study Area-
Portion of the Northern Highlands Lake District of Wisconsin and the Upper Peninsula of Michigan.

60 30 0 60 Miles

2

Procedure #3
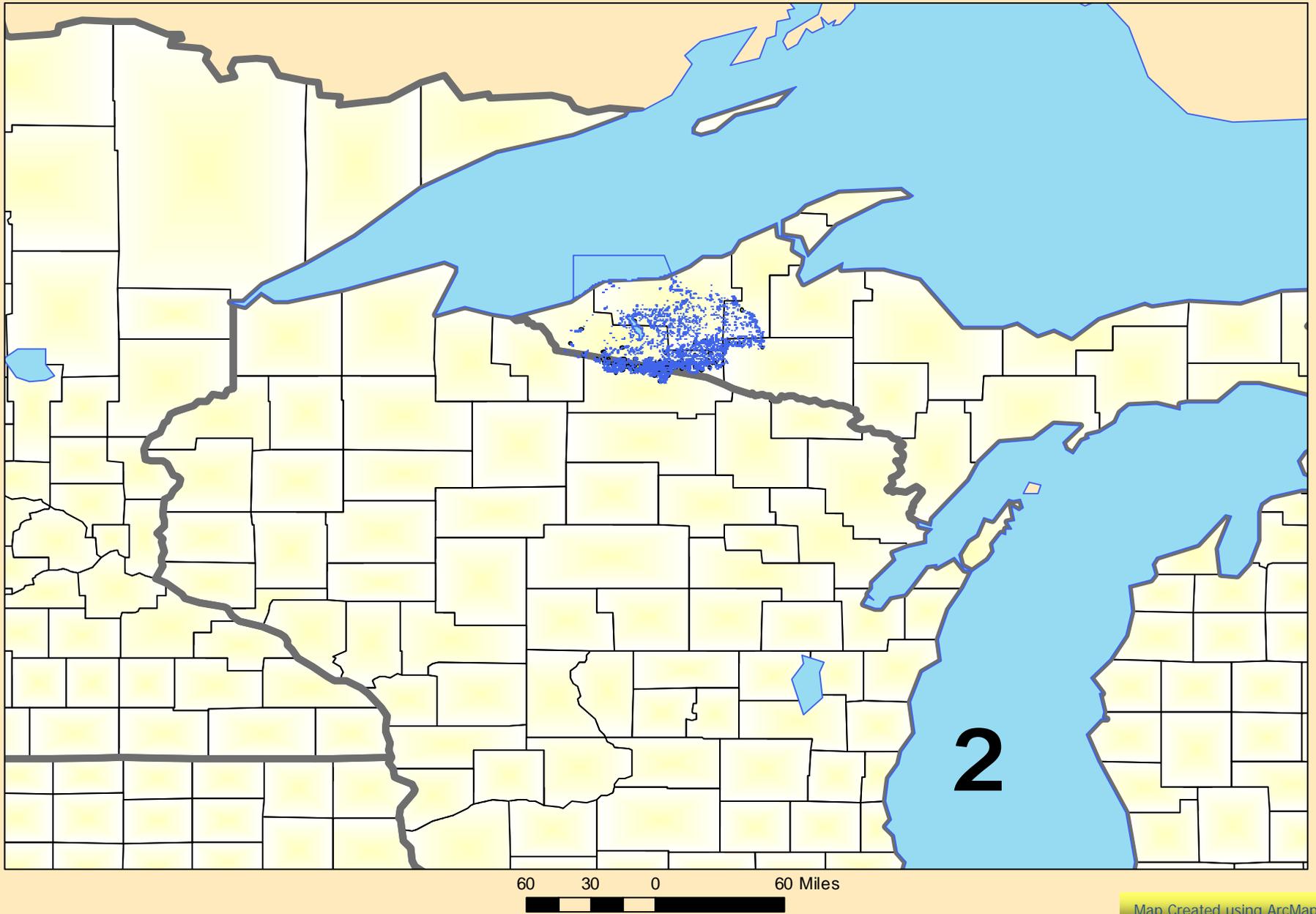
Study Area-Stations
The stations which calcium records were sampled are shown below.
http://www.epa.gov/storet
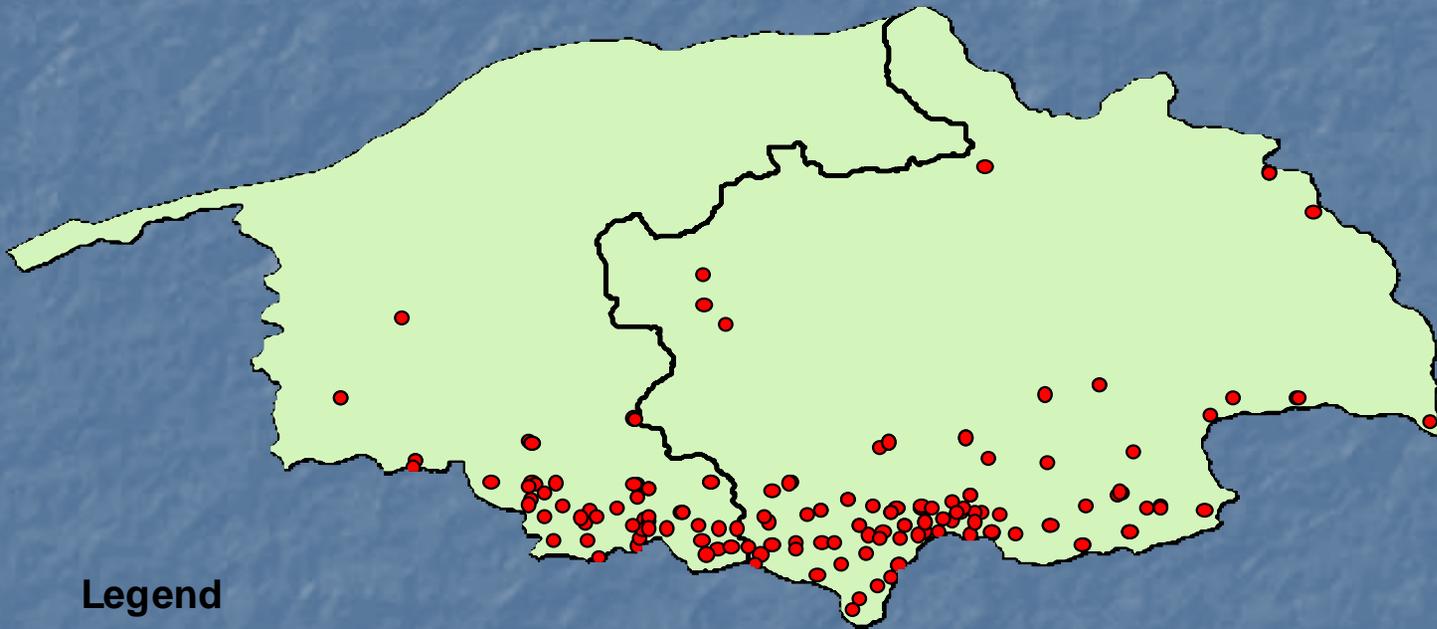
Legend

● Stations_Cal

▭ Subbasin

▭ StudyArea_Dissolve

0 3.75 7.5   15 Miles

Study Area-
Portion of the Northern Highlands Lake District of Wisconsin and the Upper Peninsula of Michigan.
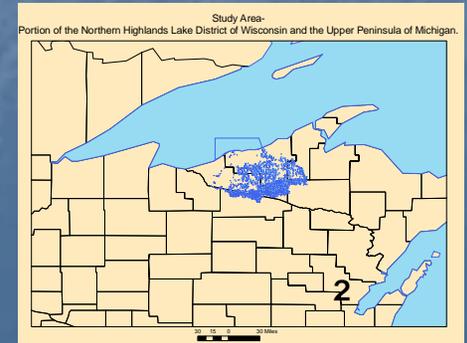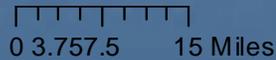
Research methods

- 3 different interpolation techniques with data using GIS

- *Interpolation is a method of constructing new data points from a discrete set of known data points.*

- Statistical Analysis of data
  - Spatial Regression Model

Why Interpolation?

- In this study, spatial interpolation yields predictions of environmental conditions in lakes that have not been field-sampled.

- These predictions can then be used in order to increase the pace of where resources are spent in order to curtail the spread of aquatic invasive species (AIS)

Findings based on research:
Analysis of Final Outcome

Based on the final outcome of the study, evidence suggests that 3 out of the 4 methods yielded unique values. For example, Method #1 had values that would be considered unique from Method #2.

<u>Unique Comparisons in Methods</u>
Method 1 – Method 2
Method 2 – Method 3
Method 2 – Method 4

Tukey's Honestly-Significant-Difference Test					
METHOD(i)	METHOD(j)	Difference	p-value	95.0% Confidence Interval	
				Lower	Upper
1	2	-167.274	**0.000**	-261.983	-72.564
1	3	-34.950	0.784	-130.549	60.648
1	4	69.932	0.382	-42.795	182.658
2	3	132.323	**0.002**	36.725	227.922
2	4	237.206	**0.000**	124.479	349.932
3	4	104.882	0.082	-8.593	218.357

Findings based on research:
Analysis of Final Outcome

Average % Difference
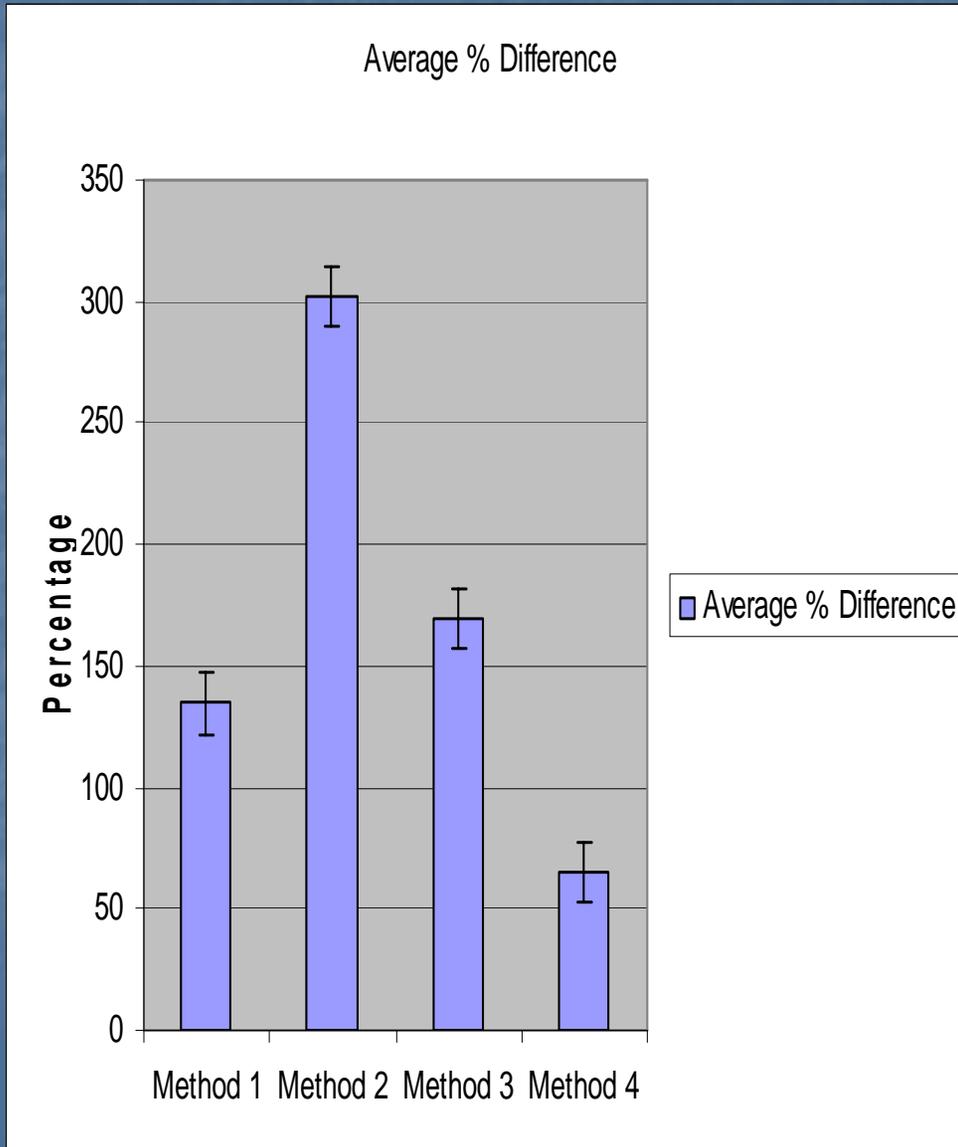
Method 2, which consisted of the Interpolation of the "-3" lake order vs. all other lakes, had the highest percentage of difference from the actual calcium levels. The other 3 methods had significantly lower percentage differences.

Conclusion and Suggestions

- Predicting environmental conditions using geospatial analysis is a <u>promising</u> and <u>worthwhile</u> technique that deserves further study.

- This particular study needs to be refined in order to gain more confidence in the results.

Further Suggestions:

Possible refining methods

- Include a larger sample of lakes into the study area
- Addition of more predictors into the research. (Elements besides Calcium)
- Refine the actual methods and the classification (Inclusion of catchment area)
- Integrate outside influences into the research (Land Use in a particular area)

Special Thanks:

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