SPATIAL PATTERNS OF HARMFUL ALGAL BLOOMS IN LAKE BLOOMINGTON AND EVERGREEN LAKE

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WHAT ARE ALGAL BLOOMS?

- A rapid increase in the concentration of algae in a water body
- Harmless and Harmful Algal Blooms
- Harmful algal blooms (HABs) produce toxins

WHY ARE THEY A PROBLEM?

HABs can cause harmful effects to;

- Freshwater - taste and odor problems in drinking water, depletion of oxygen levels
- Humans and wildlife - skin irritation, diarrhea, vomiting, stomach pains, death
- Aquatic life - Create dead zones in the water and cause fish die off
- Industries that depend on clean water - Raise treatment costs for drinking water

Lake Erie in Toledo

Monitoring Algal Blooms

Field Sampling

Secchi Disk

- It is expensive
- It is time consuming
- It is difficult for the whole lake area to be sampled

Remote Sensing

- It is inexpensive
- Less time consuming
- More lake areas can be sampled

Research Questions

1. What is the spread behavior of Algal Blooms in lakes?
    - I expect to see algal blooms spread from the edges of the lakes to the middle of the lake

2. What are the conditions that influence and facilitate spread?
    - Spread influenced by Nutrients and Temperature

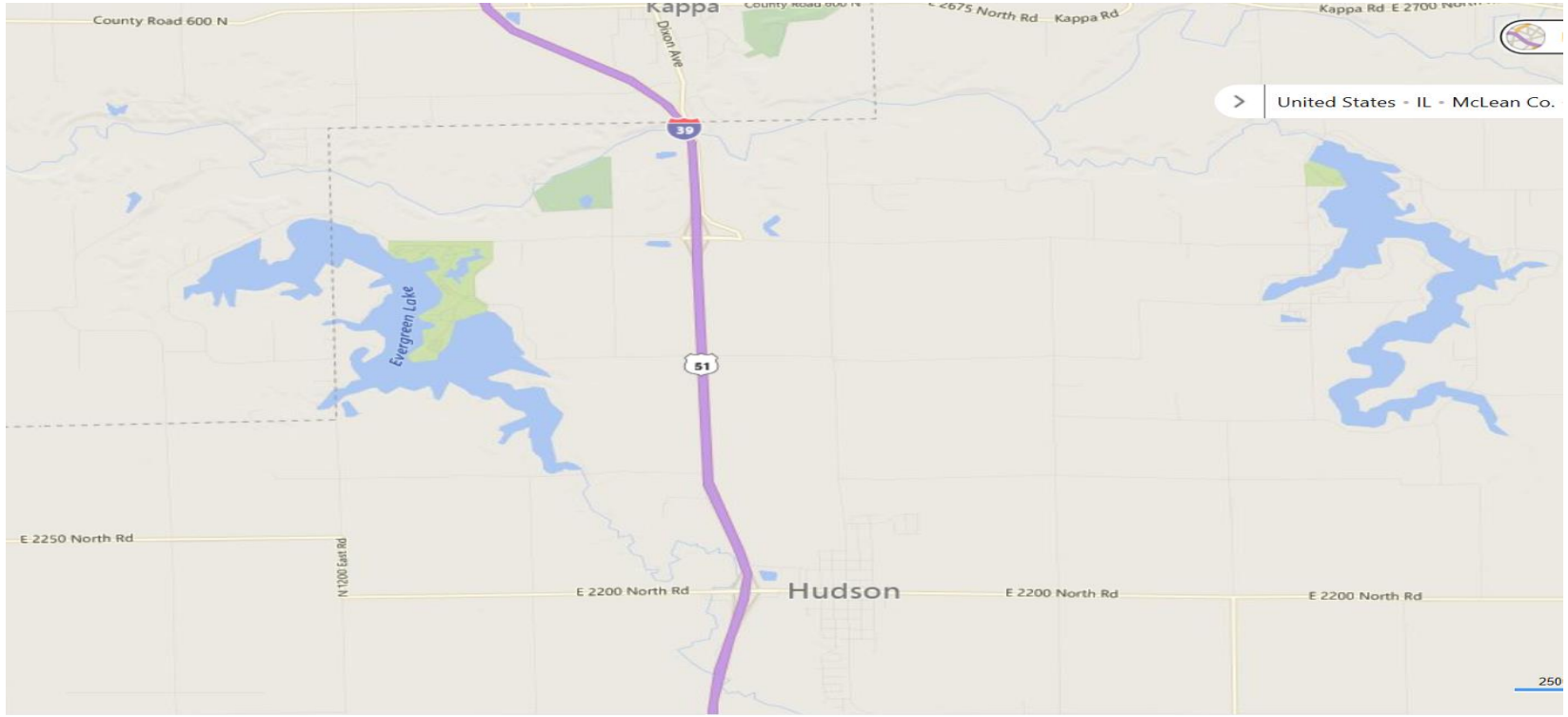
3. What are the effects of Algal Blooms on water properties?
    - Water properties quality decrease with increasing algal bloom population

Objectives

- To predict algal blooms spatial patterns using remote sensing
- To understand conditions that influence and facilitate this spread
- To determine the effects of algal blooms on water properties

Study Site

- The study area for this project is Lake Bloomington and Evergreen Lake.



EVERGREEN LAKE– 15 miles North of Bloomington IL. 925 acres. Average depth of 19.7’. Maximum depth is 50ft

LAKE BLOOMINGTON – 15 miles North of Bloomington IL. 635 acres and 18.5 miles of shoreline. Average depth is 14.5ft

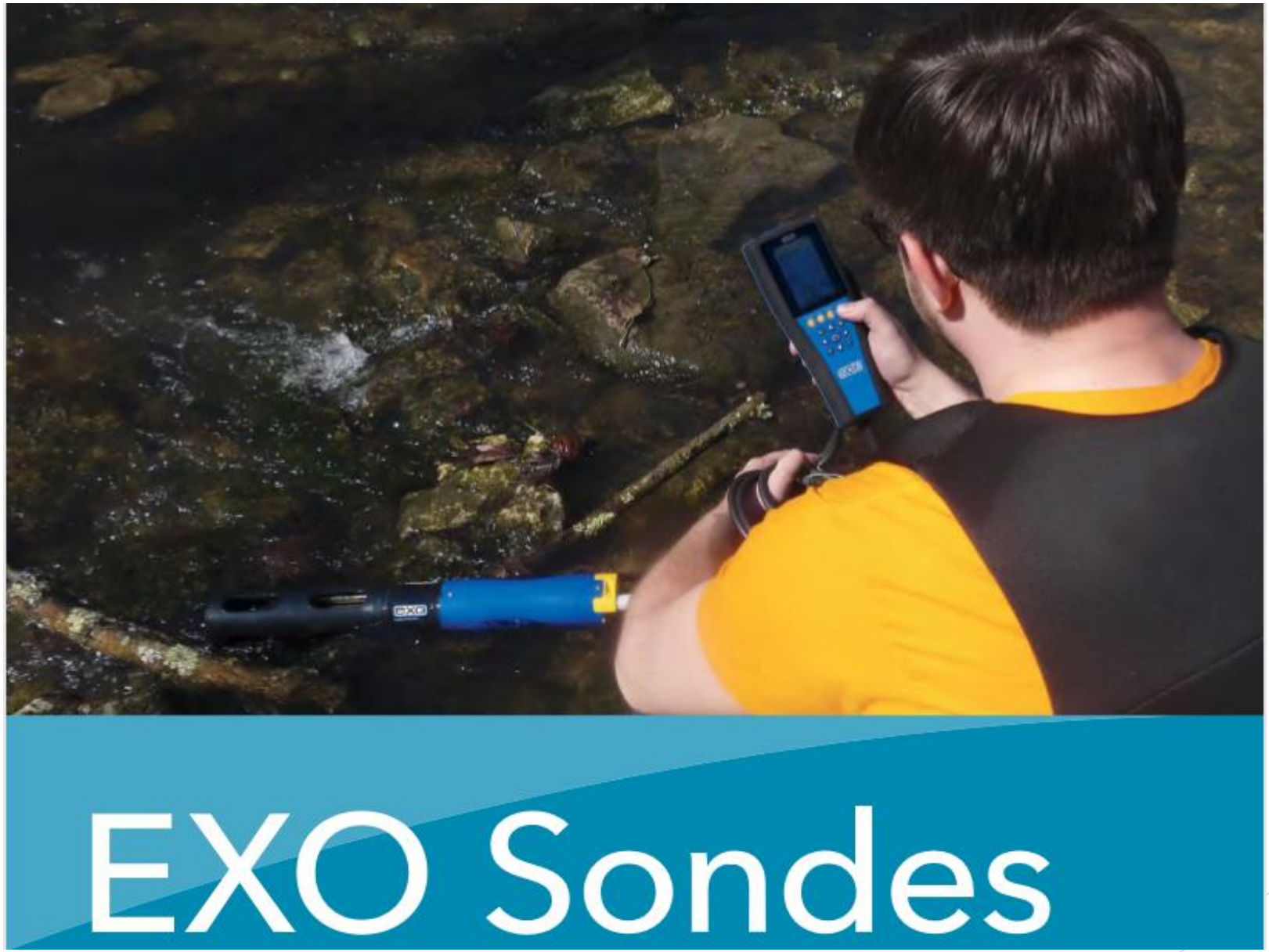
Methods

- Field and historical water quality data analysis
- Remote Sensing
- Statistical Analysis

Field Sampling

- EXO SONDE

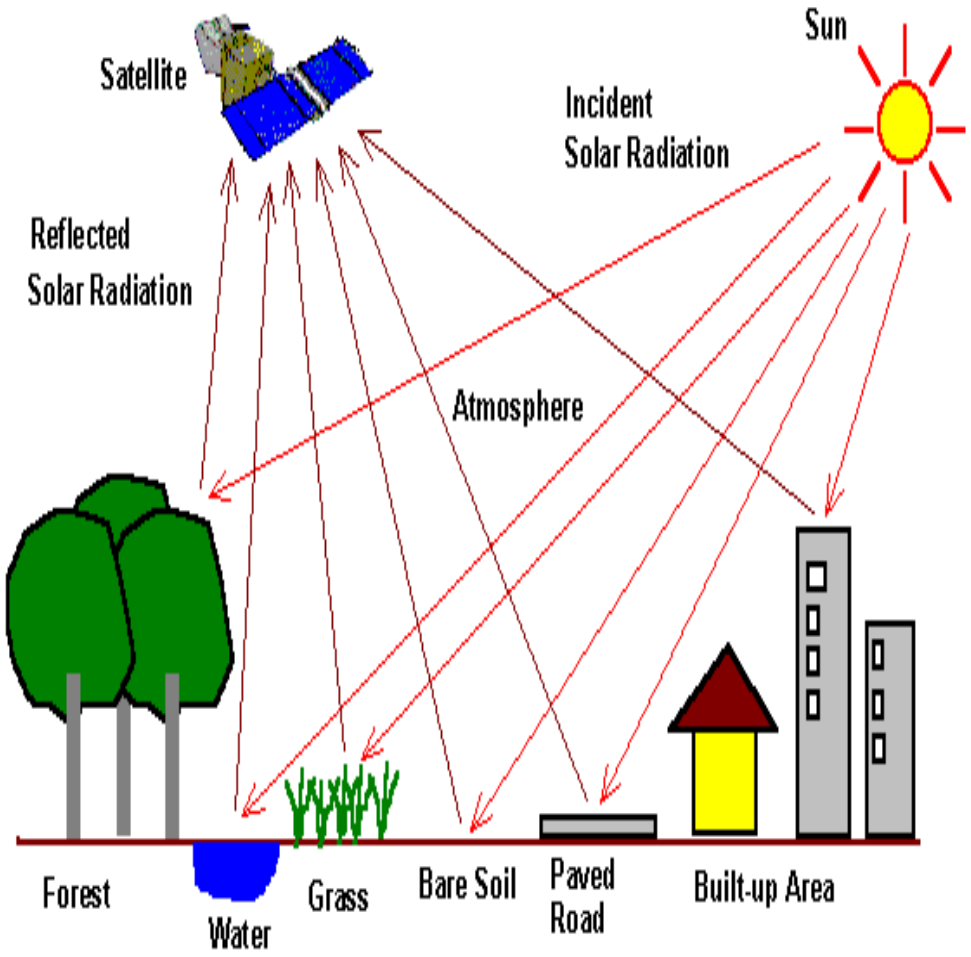
Sonde with Probe Guard and Calibration Cup

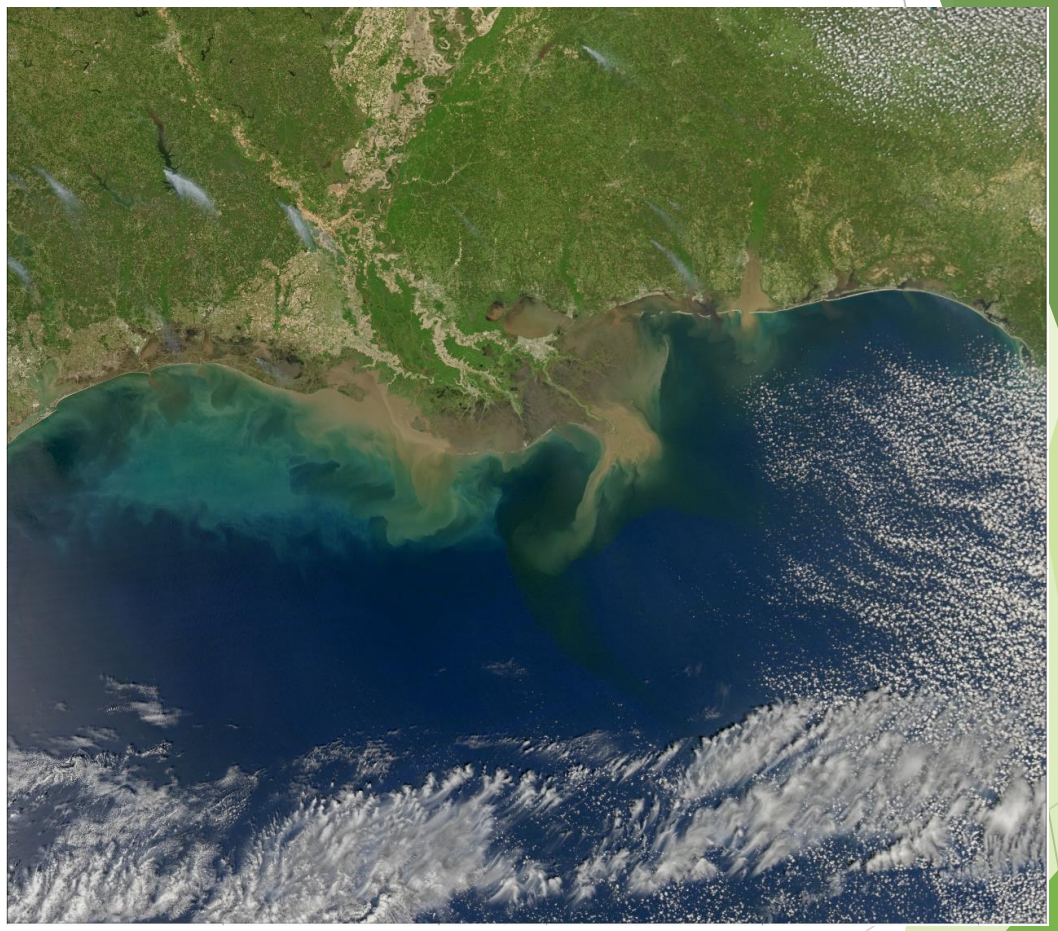

EXO Sondes

EXO Smart Sensors

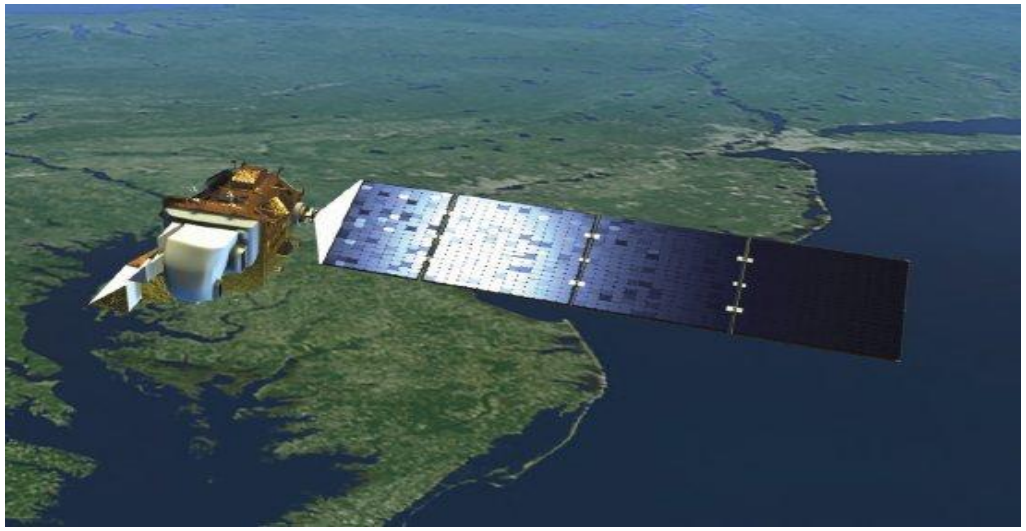
Cond / Temp	pH / ORP	Optical Dissolved Oxygen	Turbidity	Total Algae (Chl & BGA-PC)
				

Remote Sensing





Collection and interpretation of information about an object without being in physical contact with the object



Landsat 8

Operational Land Imager (OLI)
Thermal Infrared Sensor (TIRS)

Spectral Resolution

Band	Band Name	Spectral range (nm)	Use Of Data	Resolution
1	New Deep Blue	433-453	Aerosol/ Coastal zone	30m
2	Blue	450-515	Pigments/scatter/Coastal	30m (TM heritage Bands)
3	Green	525-600	Pigments/Coastal	
4	Red	630-680	Pigments/Coastal	
5	NIR	845-885	Foliage/Coastal	
6	SWIR2	1560-1660	Foliage	
7	SWIR3	2100-2300	Minerals/Litter/no scatter	
8	PAN	500-680	Image sharpening	15 m
9	SWIR	1360-1390	Cirrus Cloud Detection	30 m
10	TIRS1	10060-11190	Surface Temperature	100*(30)
11	TIRS2	11500-12510		100*(30)

Overpass time: 16 days

Flow chart For Methods

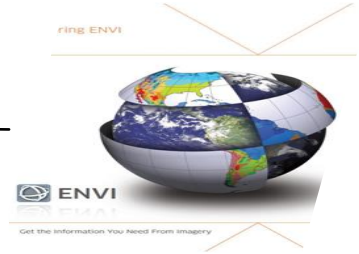
Lake Sampling

Remote Sensing

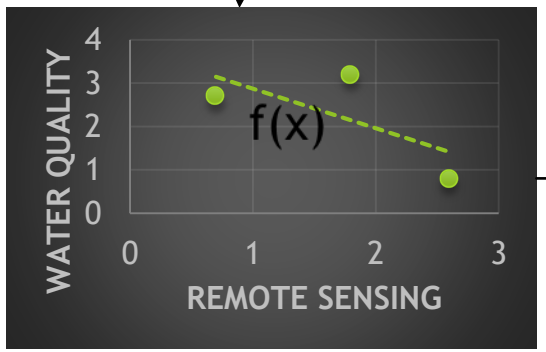
Lab Analysis

Input

Processing Landsat image



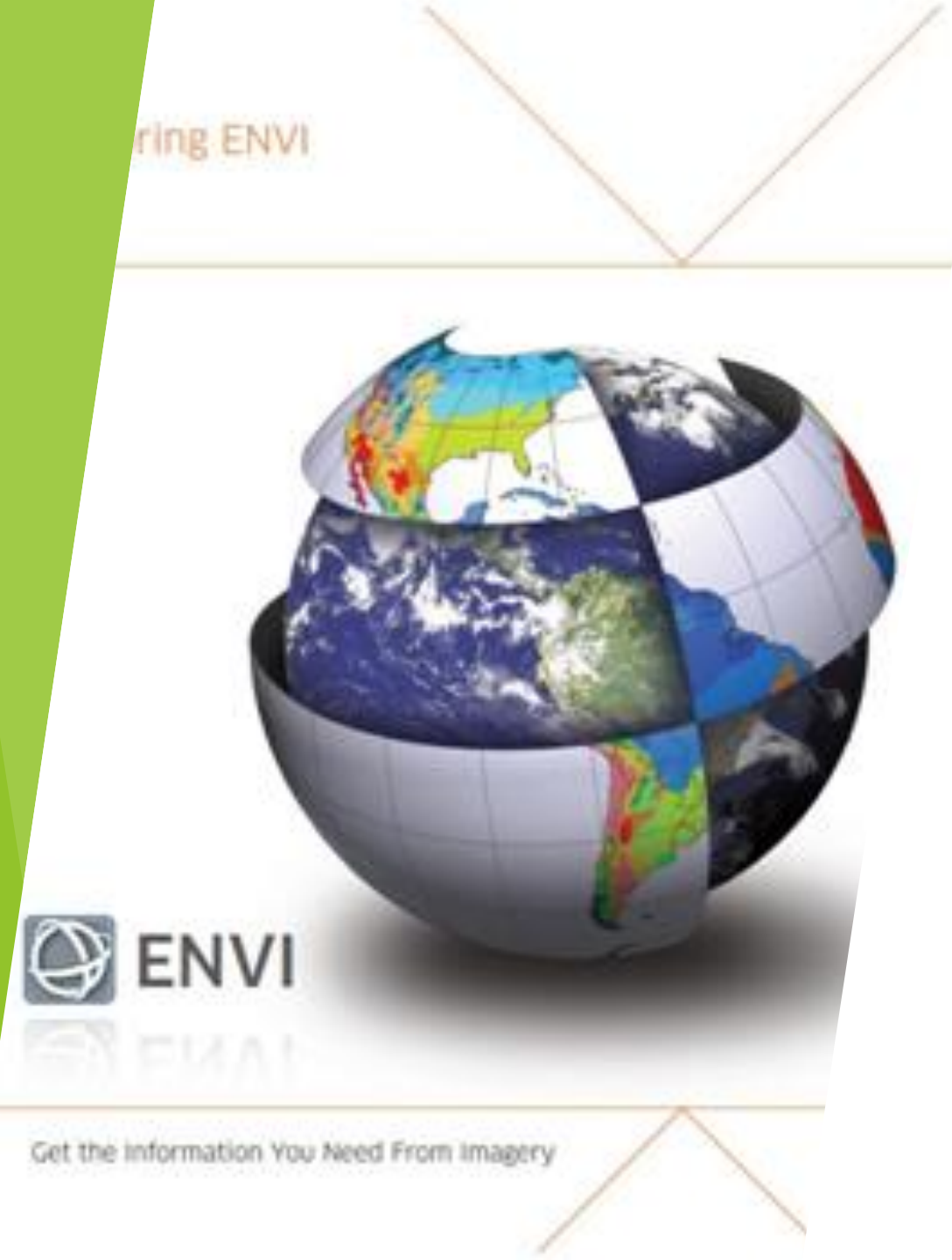
Linear Regression Model



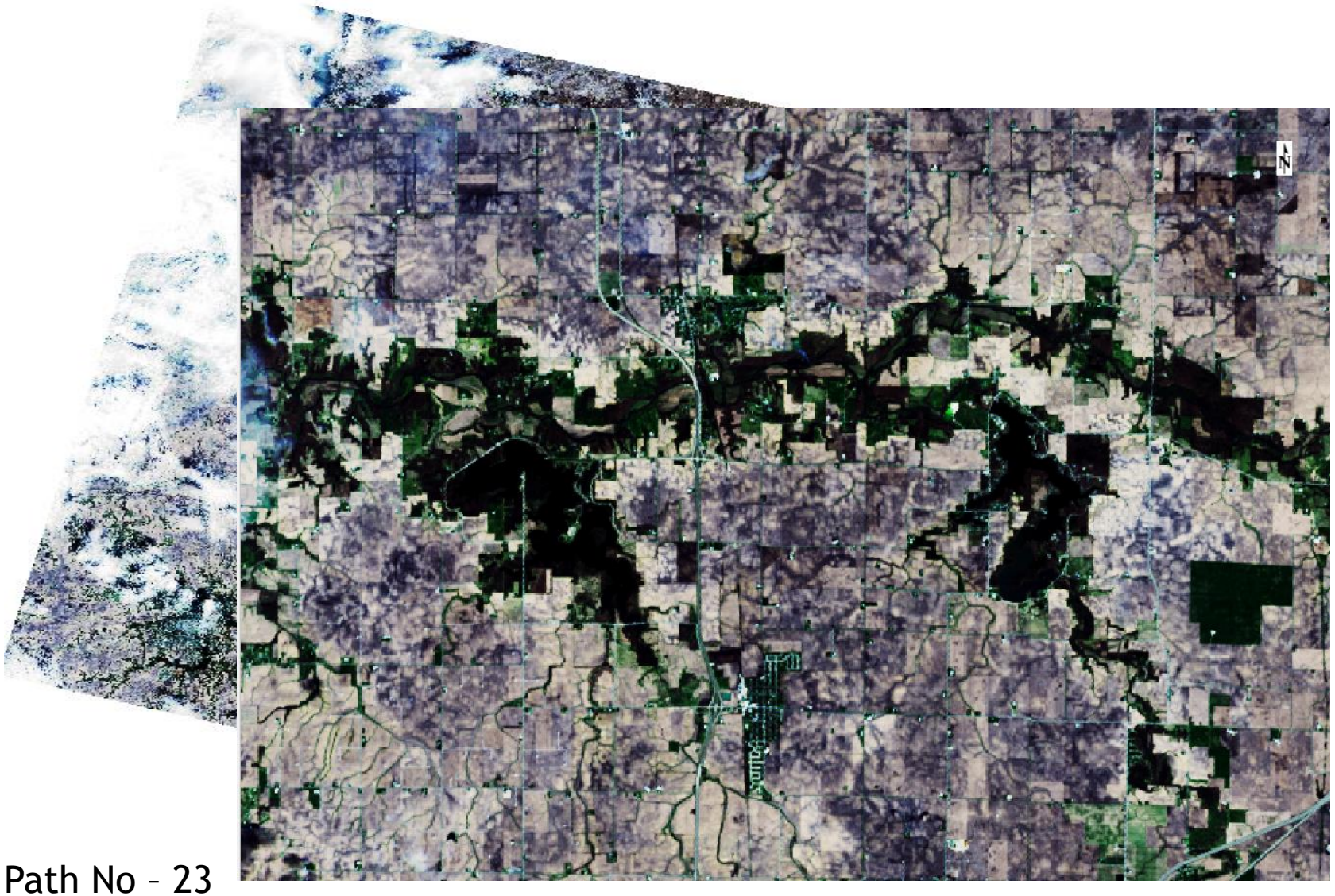
Remote Sensing

f(x)

Predict water quality



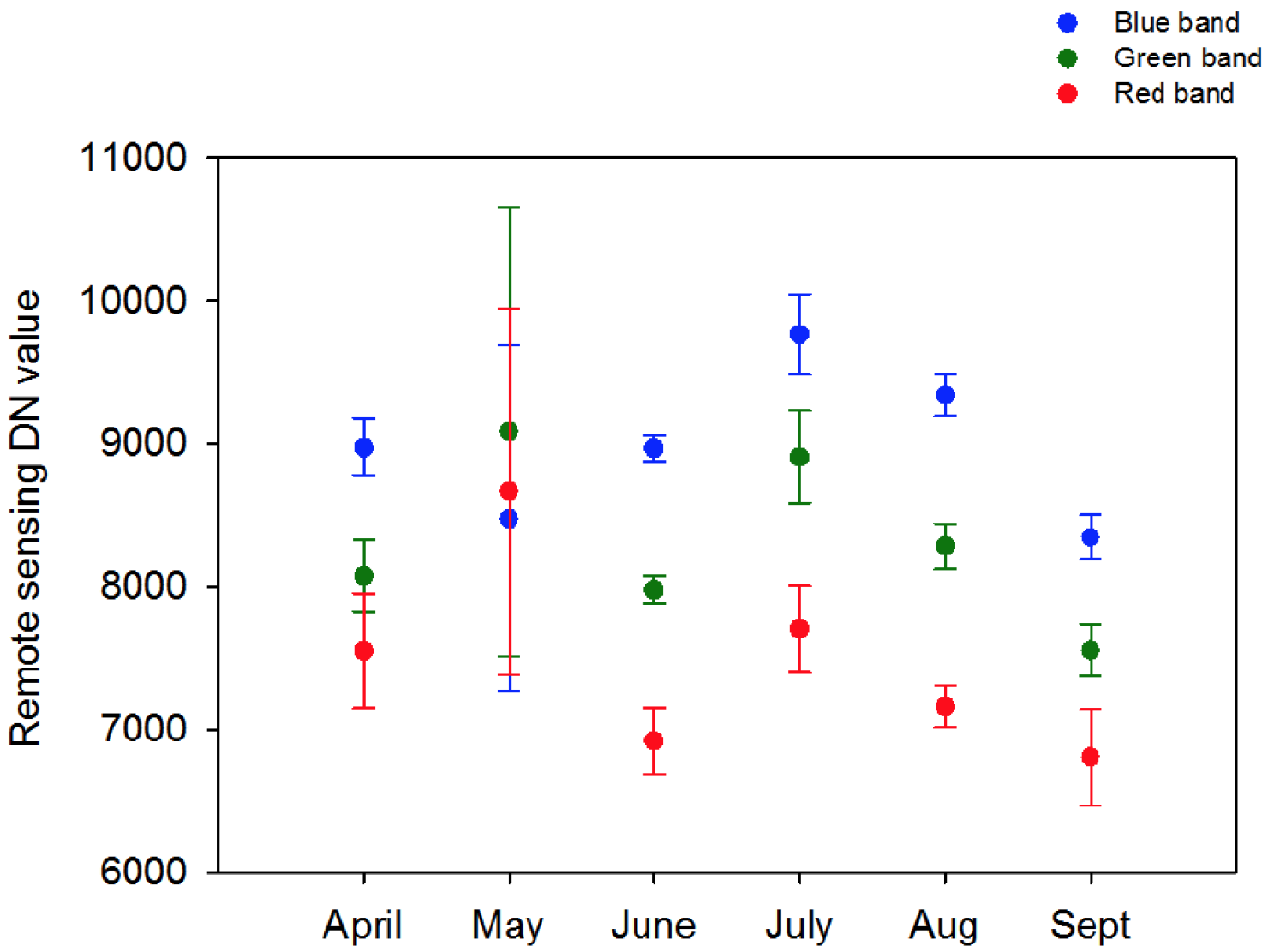
Preliminary Test



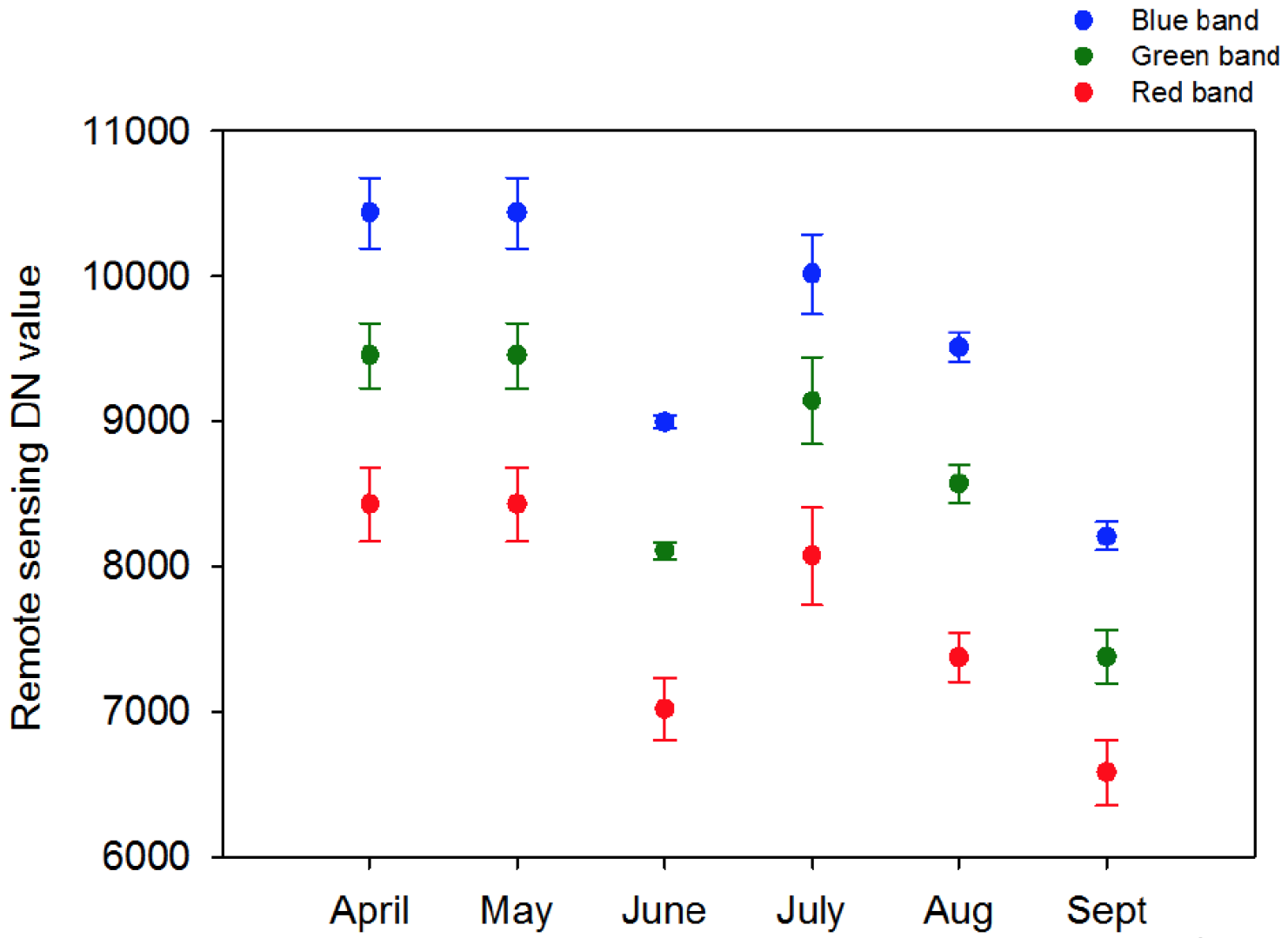
Path No – 23
Row No – 32
12 images in total for the time frame
9 used

These Images have been altered to appear brighter

Lake Bloomington



Evergreen Lake



Preliminary Conclusions

- Raw, unprocessed remote sensing data suggests that
  - Lake Bloomington has a lot of spatial variation
  - Evergreen Lake has less spatial variation but shows a seasonal trend.
- These patterns are generally similar to what is seen in the Volunteer Lake Monitoring Program Secchi disk data.

- Potential for use of remote sensing exists

Next steps

- Field Sampling in the summer 2018 to create relationships between remote sensing and chlorophyll, Secchi, turbidity
- Use of reflectance values
- Other processing approaches
  - Band ratios
  - Adding up bands

Thank you….

Questions?