Assessing Lake Water Quality and Quantity Using Remote Sensing

Kameron Daniel,[1,3] Aiswariya Suresh,[2,3] Stephany Paredes Mesa,[3] Tarendra Lakhankar[3]

1 – New York City College of Technology, New York City, NY 11201, U.S.
2 – Stuyvesant High School, New York City, NY 10282, U.S.
3 -The City College of New York, New York City, NY 10031, U.S.

Introduction & Objective:

The Earth is 71% covered in water, with 97% being saltwater and 3% being freshwater. Out of that 3%, only 0.3% percent of that freshwater is accessible from lakes.However, due to human activities, its quality and availability has been decreasing. This problem can affect jobs and the livelihood of individuals who use lakes as a source of income, consumption and recreation. Most importantly, lakes can preserve biodiversity by lessening the impact of floods and droughts as a means for storing large quantities of water and then subsequently releasing a smaller amount. Therefore, the need to study the conditions throughout the years of these invaluable resources is crucial.

The objective of this project is to check how lakes' water quality and surface areas has changed during a determined period of time.

Methodology:

A total of six lakes throughout the world were chosen based on their impact on human livelihood for this research.

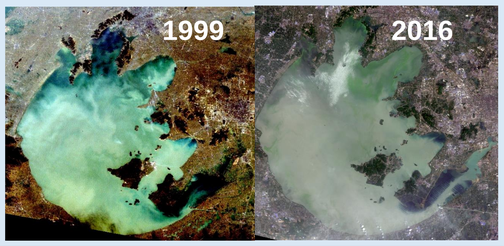
- Satellite data from Landsat 5,7,and 8 was downloaded from EarthExplorer for the same month in the span of a decade.
- Shapefiles were created to calculate surface areas of the lakes for each year, using ArcMap.
- Inherent Optical Properties for chlorophyll and sediments were used to determine their presence in the water. Chlorophyll absorbs in the red and blue bands while sediments absorbs mainly in the blue band.
- Cropped images of the satellite data for the lakes were used to extract RGB values.
- Both surface areas and RGB values were plotted using Microsoft Excel for further analysis.

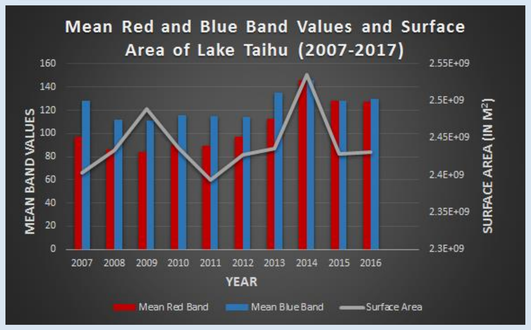
References:

- Daigle, K. (2016, November 11). India Sees Kashmir's Storied Wular Lake Worth More Restored. Retrieved August 04, 2017.
- Mohan, L. (2012, November 09). Earth's Freshwater. Retrieved August 04, 2017.
- Brunswick, C. G. (2016, July 26). The Importance of Lakes - Environment and Local. Retrieved August 04, 2017.
- Stone, R. (2011, July 21). On Lake Taihu, China Moves To Battle Massive Algae Blooms. Retrieved August 04, 2017

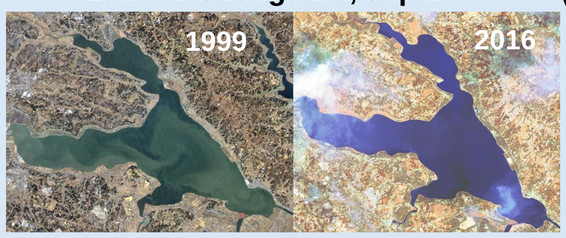
Results:

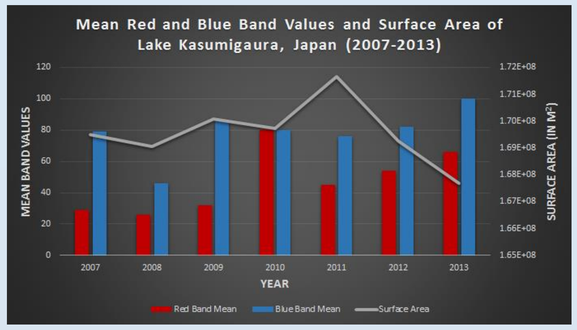
Lake Taihu, China



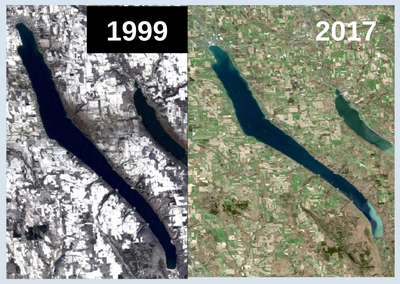


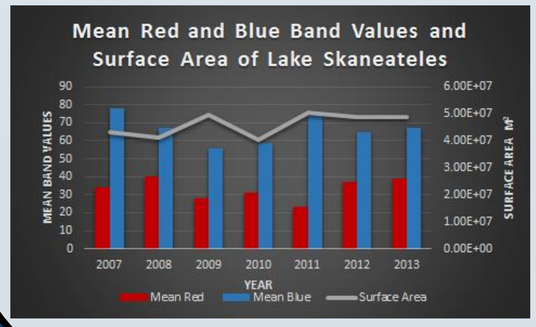
Lake Kasumigaura, Japan



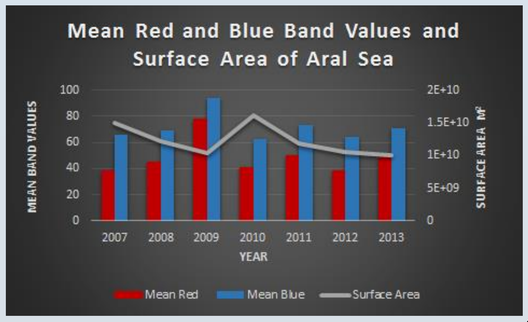


Skaneateles Lake, USA





Aral Sea, Central Asia



Analysis & Conclusion:

For the quantity analysis, it was concluded that:

- 1 out of the 6 lakes experienced a noticeable decrease in surface area in a decade. (Aral Sea, Central Asia)
- Most lakes seem to have an apparent constant surface area during the selected period of time.
- 10 years is not a sufficient time frame to obtain a solid conclusion of the behavior of the lake's surface area due to normal variation in annual measurements.

For the quality analysis, it was concluded that:

- All the lakes had a majority of the blue band values greater than the red band values, which infers that there is a high absorption of red light by the presence of chlorophyll.
- The range of the mean values for the red and blue bands were low which means that there is high absorption because of the presence of algal blooms and sediments in the lakes.

Future Works:

- Expand the timeframe of each lake to get a clear representation of the change in surface area.
- Correlate findings with previous research articles for the chosen lakes.
- Using the previous data studied, the issues addressed can be evaluated to visualize how this may harm civilians seasonally.

This research project and my HIRES summer research internship are funded by the Pinkerton Foundation under the Cuny Crest Institute.
NOAA-CREST program is funded by NOAA/EPP Grant # NA11SEC4810004.
NOAA CREST HIRES program is a part of the Science Research Mentoring Program and funded by Pinkerton Foundation.

This project is supported by the National Science Foundation Research Experiences for Undergraduates Grant # 1560050, under the direction of Dr. Reginald A. Blake, Dr. Janet Liou-Mark, and Ms. Laura Yuen-Lau and NOAA-CREST Bridge program under the direction of Dr. Reza Khanvilbari and Dr. Shakila Merchant.