NSERC Canadian Network for Aquatic Ecosystem Services

Theme 2, Project 2.1

Susceptibility of oligotrophic lakes in Ontario to formation of algal blooms

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Abstract

Oligotrophic lakes in the temperate forests of eastern North America appear to be experiencing an increase in the frequency and duration of algal blooms. This has been the focus of numerous public and government reports, resulting in heightened public concern and reporting of algal blooms. We are conducting a detailed historical survey of numerous lakes, covering large spatial scales (the scale of region, province, or entire country) and temporal scales (decades) to determine if public observations are accurate. We used a remote sensing approach to (1) develop regression models that relate Landsat imagery reflectance to chlorophyll-a (Chl-a) as a proxy of algal biomass of lakes; and (2) apply these models to estimate Chl-a in lakes at the northern edge of the temperate forest biome in central Ontario over a 28-year period (1984–2011). The linear regression model was built using the normalized exoatmospheric reflectance values acquired from the utility of Landsat TM and ETM imagery and *in situ* measurements. Landsat band 3 (red) showed the strongest correlation with *in situ* data, explaining 84% of the variance in Chl-a (r^2 = 0.84, p <0.001). We applied this model to all lakes within the region selected from *atmospherically corrected Landsat data* for the peak algal bloom period (late July to early November) for the entire 28 years. A time series revealed a cyclic stationary pattern in the average Chl-a. This pattern followed the regional patterns of major droughts, especially for the first part of the time period, making climate a major driver in the formation of algal biomass in lakes that, in turn, can lead to the rise of algal blooms. However, this climate driver appeared to become less predictable later in the record, with elevated algal biomass occurring in both normal and drought years,

Keywords: biogeochemistry, climate change, water resources, nutrient cycling, phytoplankton, remote sensing applications

Geographic Location: The Algoma Highlands/Temperate Forest Ecozone, Ontario, Canada

How does your project link to Canadian aquatic ecosystem services?

The presence of phytoplankton communities and algal biomass can affect several aquatic ecosystem services, including fish populations, water quality and tourism. The outcomes of the project will identify which factors are associated with reported algal blooms and allow researchers to target monitoring efforts on the potentially susceptible lakes throughout Canada.