

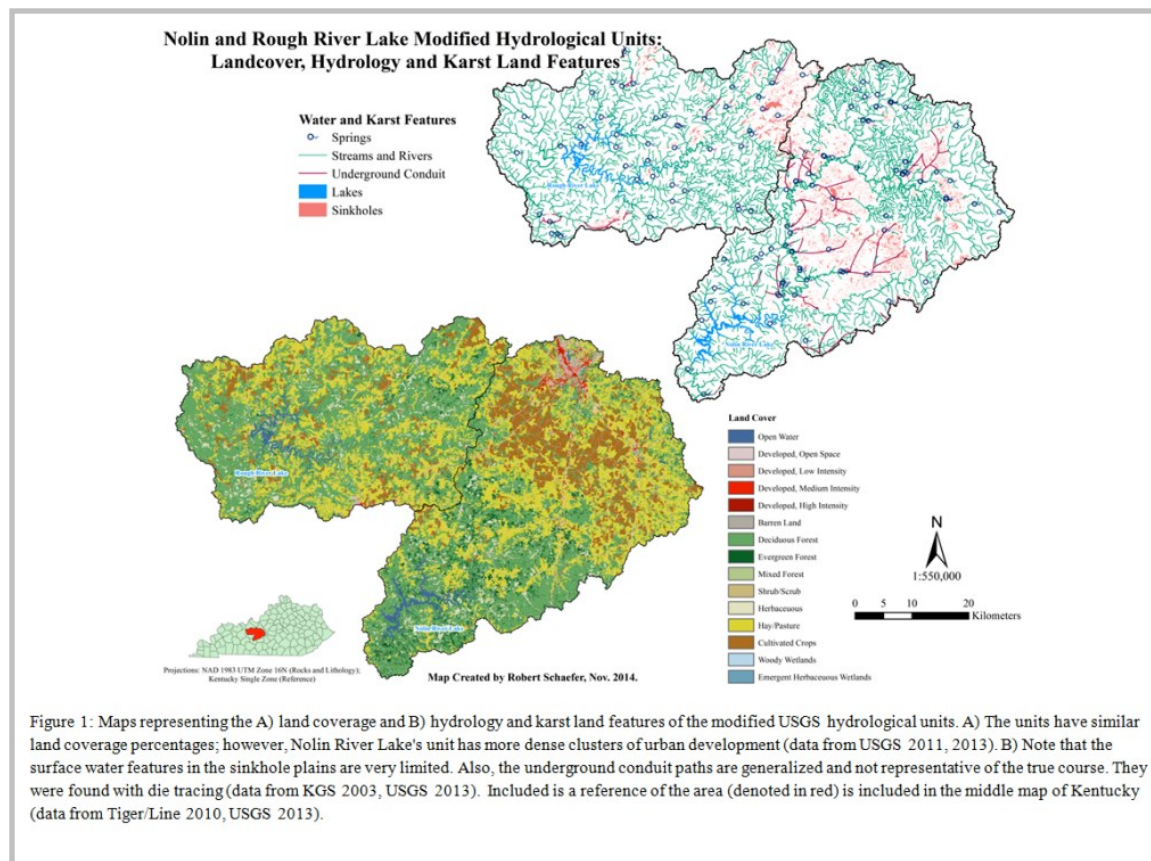
Analyzing possible influences in Karst Regions Contributing to Harmful Algal Bloom Occurrences in Freshwater Lakes

Robert Schaefer, Jason S. Polk, Kegan McClanahan

Center for Human-GeoEnvironmental Studies, Western Kentucky University,
Bowling Green, KY 42101 United States,

HABs, or harmful algal blooms, are occurring in lakes in central Kentucky, which is a large karst region. These HABs consist of blue-green algae (cyanobacteria), which can bloom in high enough densities to pose a threat to human health and ecosystems through the production of cyanotoxins. During the year of 2013, several Kentucky lakes and reservoirs were placed under water quality advisories by the United States Army Corps of Engineers (USACE) in regards to high cell count densities of cyanobacteria, per World Health Organization (WHO) guidelines. Both Nolin River Lake and

Rough River Lake (Figure 1) were placed under advisory. These lakes play important roles for the local communities as sources of water, recreation, income, and flood control as well as serving as the communities' economic centers. The HABs pose a threat to these communities, yet little has been done to study their formation or spatial distribution, particularly within the context of karst groundwater inputs. Interestingly, these lakes have had HABs form in winter months, a rare occurrence. This winter bloom phenomenon has not yet been studied, though understanding why it occurs is



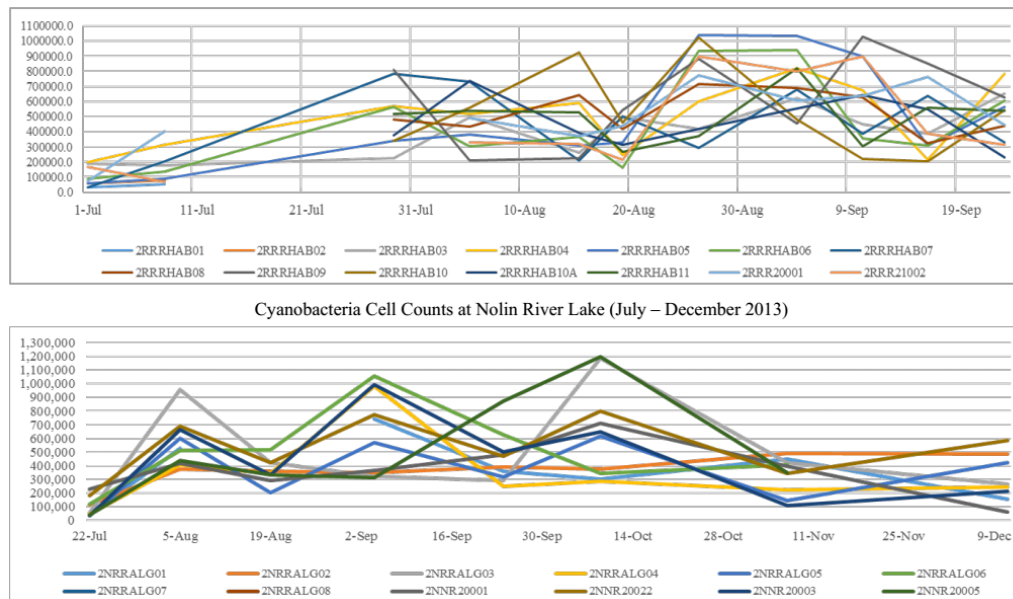


Figure 2: The cell count data collected during 2013 for each lake. The graphs show HABs occurring throughout the seasons, including winter. A dangerous bloom is one that has a cell count over 200,000 cells/mL, by WHO standards.

important due to the health threats presented by these HABs. The USACE monitored the cyanobacteria cell counts in the lakes for the last two years, but the lakes were sampled on different schedules and different selection criteria were used to select the sample sites. Currently, monitoring is being done on a bi-weekly basis for multiple parameters, which include pH, SpC, temperature, nutrients, and N isotopes with sampling sites near karst inputs. Together, these data will be used with the existing data in a GIS to spatially analyze the possible karst influences on HAB occurrences in the two lakes being studied. A spatial analysis of the historic sample sites and cell count data for 2013 were entered into a geodatabase and examined utilizing the inverse distance weighted average tool from Desktop or ArcGIS 10.2.2. Results indicate possible contributions from karst groundwater inputs may be contributing to the timing and

occurrence of HABs in these karst influenced lakes, particularly in the winter. Further qualitative analysis using GIS analysis involving the landuse, hydrogeology, and population densities surrounding the lake when paired with the historic bloom data revealed interesting results (Figures 1 & 2). The peaks of the blooms seem to correlate with certain landuse practices that may have an effect on their occurrence. These blooms are seemingly occurring during time periods in which karst influenced groundwater is the likely source of nutrient contamination. The nutrient laced karst groundwater also maybe the cause of the winter blooms.

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