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Quantifying Chlorophyll and Phycocyanin of Drinking Water Reservoirs through GA-PLS Modeling of Hyperspectral Reflectance

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Indianapolis's three drinking water reservoirs, Eagle Creek, Morse, and Geist Reservoir are impaired due to the occurrence of blue-green algal blooms. Mapping blue-green algae (e.g., *Anabaena*, *Aphanizomenon*, and *Cylindrospermopsis*) is critical to developing prevention, mitigation, and response strategies to minimize the negative impacts of blooms. The objective of this study is to develop remote sensing methods to meet this mapping need. This contribution focuses on the development of algorithms for mapping Chlorophyll-*a* and phycocyanin. Genetic algorithms coupled with partial least squares (GA-PLS) were developed and the performance of GA-PLS modeling at retrieving Chorophylll-*a* and phycocyanin from spectral reflectance was evaluated. The rationale for this coupling lies in that the genetic algorithm was used to identify a subset of spectral bands sensitive to the variation of Chlorophyll-*a* and phycocyanin concentrations, then PLS was applied to relate the reflectance of the identified bands to Chlorophyll-*a* and phycocyanin concentrations. We expect that GA-PLS will yield better results than PLS alone

Spectral data for all three reservoirs consisted of ASD field reflectance spectra collected in the summers of 2005 and 2006. Spectral data were measured concurrently with water sample collection. Samples were extracted and fluormetrically analyzed for Chlorophyll-*a* and phycocyanin. PLS modeling using ASD field reflectance spectra demonstrated high correlation between measured and estimated Chlorophyll-*a* for Geist (r^2 =0.960) and Morse (r^2 =0.956). After being tested across all reservoirs and finalized, GA-PLS will be applied to reservoir images collected by Applied Imaging Spectrometer for Application (AISA) to map Chlorophyll-*a* and phycocyanin.