

UAS Survey to Support EPA Region 7 HAB Monitoring

USACE Harmful Algal Bloom Research & Development Initiative



Delivering scalable freshwater HAB prevention, detection, and management technologies through collaboration, partnership, and cutting-edge science.

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Problem

Harmful algal bloom (HAB) monitoring continues to be challenging for many agencies and it is unclear how new technology, such as unmanned aircraft systems (UAS), can assist with monitoring and better understanding of hyperspectral image capabilities for detecting HABs.

Objective

Assist EPA Region 7 with ongoing HAB research and development by evaluating new UAS technology, including hyperspectral imagery for identifying spectral signatures of cyanobacteria genera and species.

Approach

Conducted a two-part experiment to evaluate hyperspectral imagery by (1) performing laboratory hyperspectral imaging analysis to better understand and identify relevant spectral bands specific to the cyanobacteria genera and species present in both laboratory monocultures (cyanobacteria and eukaryotic algae) and field samples from Milford Lake, Kansas and (2) conducting a coordinated field survey with simultaneous collection of in situ samples (physical water samples and sonde measurements) and UAS hyperspectral imagery over a small target area in Milford Lake, Kansas.

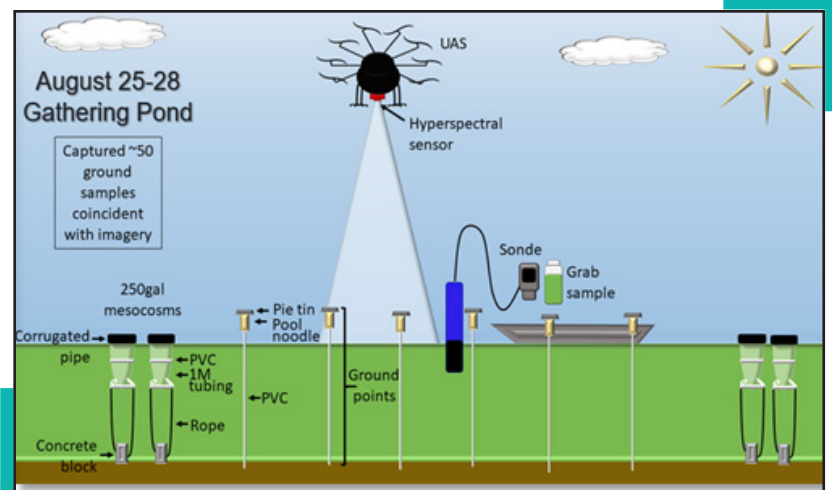


Figure 1. Conceptual diagram.

Major Milestones

Deliverable	Description
Publications	<p>Journal Article: Pokrzywinski, K., R. Johansen, M. Reif, S. Bourne, S. Hammond, and B. Fernando. 2022. "Remote Sensing of the Cyanobacteria Life Cycle: A Mesocosm Temporal Assessment of a <i>Microcystis</i> sp. Bloom Using Coincident Unmanned Aircraft System (UAS) Hyperspectral Imagery and Ground Sampling Efforts." <i>Harmful Algae</i> 117:102268. https://doi.org/10.1016/j.hal.2022.102268.</p> <p>Journal Article: Pokrzywinski et al. In prep. "Hyperspectral Remote Sensing to Identify Spectral Signatures of Cyanobacteria Genera and Species."</p>
Documents	<p>Internal Field Plan: Reif et al. 2021. Field sampling plan and overall data collection & coordination plan for the Gathering Pond, Kansas (ERDC, EPA, NOAA, University of Florida, and USACE Kansas City District [NWK]).</p>
Products	<p>Spectral Library (Reference) Database: Link to federal partners (anticipated)</p>

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Partnership/Leveraging Opportunities

ERDC's Environmental Laboratory has a variety of current and ongoing research and development efforts to evaluate the efficacy of UAS and other remote-sensing technologies for improved monitoring of HABs. Specifically, this work leverages multiple agency resources to evaluate UAS technology. It will provide a critical step in examining the technology for species identification and, potentially, to better understand the relationship between toxin production and species-specific spectral characteristics that can be used for monitoring. As such, coordination with other agencies is likewise ongoing to advance the state of the science for maximizing benefits to improve HAB response.

Value to USACE Mission

This work leverages support from EPA Region 7, including funding and field sampling; assistance from NWK for boat support; support to NOAA for field sampling, sample processing, and spectral analysis; and support to the University of Florida for field sampling and sample processing/analysis.



Figure 2. Researchers in the field collecting samples.



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