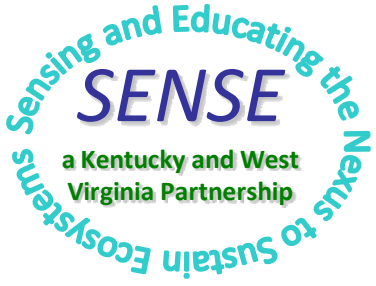

SENSING AND EDUCATING THE NEXUS TO SUSTAIN ECOSYSTEMS (SENSE): A KENTUCKY-WEST VIRGINIA PARTNERSHIP

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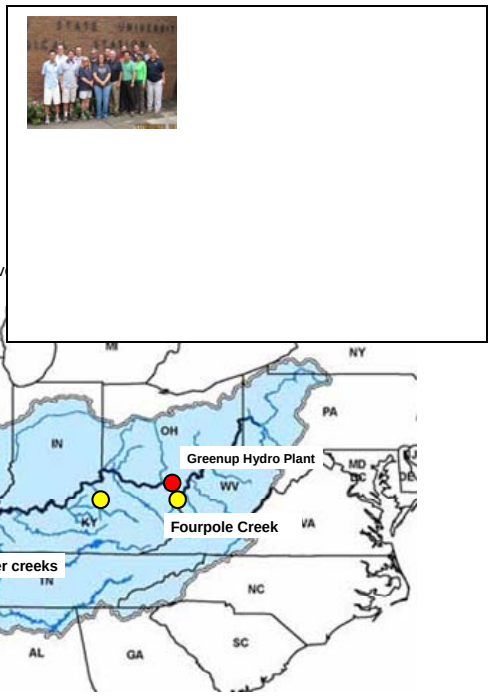
"SENSE" is a new research program funded by NSF-EPSCoR (2016-2020) that builds on previous cyberinfrastructure to address water quality issues shared between Kentucky and West Virginia. The overarching goal is to provide advanced aquatic sensor systems, train students and new faculty in their use, and apply resulting data to emerging environmental problems common to both states. Three lead universities, including Murray State University (KY), the University of Kentucky, and Marshall University (WV), are addressing Food-Energy-Water issues while providing an enhanced research environment for new faculty and students. SENSE is framed within the context of *harmful algal blooms*, or cyano-HABs, comprised mostly by toxic cyanobacteria that are a water quality threat shared by both KY and WV. Cyano-HABs impact drinking water, human health, wildlife and livestock, aquatic life, irrigation sources, and energy production. Although much world-wide attention recently has been focused on HABs, the causes of blooms are not well-understood. Rapid changes in land use, the effects of climate change on precipitation quantity and distribution, and increasing human population pressures on energy production and water use create an interconnectedness that structures ecosystems and increases hydrocomplexity. The complexity of cyano-HAB prediction reflects an example of food (e.g., agriculture), energy (e.g., hydropower), and water (e.g., toxic blooms) interactions for which SENSE aims to help solve.

Cyano-HABs and water quality issues are being addressed by using the latest sensor technology, cyberinfrastructure, and watershed modeling methods on the Ohio River, Kentucky Lake, and contributing agricultural tributary systems. High-temporal resolution sensor infrastructure is being placed at strategic sites in each of these systems. Sensors will monitor a suite of water chemistry parameters (including innovative NO_3 and PO_4 sensors), weather conditions, and algal pigment concentrations (e.g., chlorophyll *a*, phycocyanin). Sensor data will be relayed in real-time or near-real time to data hubs for the purpose of developing predictive models that can better explain and forecast conditions leading to cyano-HABs and provide novel insights and information for understanding the physical, chemical, and biological responses of water bodies to rapidly changing human pressures and perturbations from agriculture and hydropower that might lead to toxic algal blooms. Kentucky Lake and Ohio River modeling efforts will focus on prediction of cyanobacterial and toxin production as a function of nutrient, temperature, and biological community conditions. Watershed-scale water quality models will evaluate simulations of nutrient fate and transport dynamics during events (e.g., precipitation, flooding) on smaller streams.

Broader impacts of the SENSE partnership will 1) enhance the workforce (~30 individuals including six early career faculty and 24 students), 2) positively impact workforce training in the region by educating

and training STEM students in the use of new technologies pertinent to water quality, modeling, and environmental engineering, 3) lead to future collaborations on new externally funded research, 4) positively affect local economies and the broader community, 5) have lasting educational impacts on research directions and 6) lead to better management of water and land resources across the region.



Mobile sensor buoy deployed at