

# HIGHLIGHTS OF FISCAL YEAR 2017 ACCOMPLISHMENTS

## BACKGROUND

The Environmental Health Mission Area (EHMA) leads USGS science that works to understand hazards that environmental contaminants and pathogens may pose to the health of humans and other organisms. Through its two programs, the Toxic Substances Hydrology Program (TSHP) and the Contaminant Biology Program (CBP), the EHMA provides salary support and operating expenses for more than 200 scientists, with facilities or activities in 29 States and 39 Congressional districts.

EH scientists work with a broad range of public health, animal health, natural resource, defense, and emergency response partners and stakeholders from across Federal and state agencies, the private sector, academia, and NGOs, by providing non-regulatory, non-advocacy science to support sound decision making. Some of our Federal partners include other Department of the Interior agencies, HHS, DHS, DOD, USDA, USEPA, NOAA, and USACE. Our unique interdisciplinary teams of hydrologists, geologists, chemists, and biologists work together to fill science gaps that are outside the mission of these other agencies, thereby adding value to these agencies' work.

Fiscal year 2017 was a year of substantial accomplishments for the EHMA and its programs. In FY 2017, EHMA-funded scientists produced more than 200 knowledge products, including peer reviewed science publications. Operationally, the EHMA realigned science activities of the Toxic Substances Hydrology Program and Contaminant Biology Program toward as many jointly studied topics as possible. Although both programs have been in existence for decades (CBP since the 1940's, TSHP since the 1970's), this realignment provides the USGS with the ability to assemble transdisciplinary, cross-program teams that address the full range of sources, environmental transport, exposure/transmission pathways, uptake, biological effects, and human health implications of contaminants and pathogens in the environment.

## SELECTED EHMA SCIENCE ACCOMPLISHMENTS IN FY 2017

### *Harmful Algal Blooms and Toxins*

USGS science helps Federal, State, and local agencies predict, monitor, understand, and mitigate the human, fish, and wildlife health hazards posed by harmful algal blooms and their associated toxins. This work is especially well-leveraged in the Environmental Health mission area because of the mission area's unique mix of scientific expertise and capabilities to not only forecast, detect, and identify algal toxins in bodies of water, but also to understand how those toxins move through the environment and potentially affect the health of humans, wildlife, and domestic animals. This **source-to-exposure science** is a unique aspect of the EHMA.

In FY 2017, EHMA continued its leadership role in harmful algal bloom/toxin studies that:



*Figure 1: An aerial view of Lake Okeechobee in Florida shows an algal bloom. A third of all lakes studied by the USGS contained toxins produced by similar blooms. Credit: Nicholas Aumen, USGS.*

- Developed advanced new analytical methods to detect low levels of a variety of cyanobacteria-related toxins in waters and other media.
- Helped advance the understanding of the specific cyanobacteria or algal species that produce toxins.
- Helped understand associations between mussel productivity and cyanotoxins in Lake Erie
- Developed a new method to quantify spatial extent of cyanobacterial blooms
- Helped biomedical scientist collaborators show that one particular cyanobacterial toxin does not have a clear association with the development of ALS (Lou Gehrig’s disease) in humans exposed to algal toxins in drinking water, as had been speculated in the health community.
- Used satellite imagery to measure algal bloom frequency and how that might help understand health risks
- Continued other work to help understand the environmental persistence of, exposure pathways to, and actual versus perceived health hazards posed by algal toxins.

In FY17, Toxic Substances Hydrology Program scientist Dr. Keith A. Loftin received the USEPA Office of Water’s Achievement in Science and Technology Award for his contributions to the National Wetlands Condition Assessment and harmful algal blooms.

### ***Contaminants and Pathogens in Surface and Ground Waters***

In FY 2017, the EHMA and collaborators within and outside the USGS completed a number of studies that assist Interior, other Federal agencies, and State and local stakeholders better understand (and, if needed, better manage) health hazards posed by contaminants and pathogens in the Nation’s surface and ground waters.

- For example, a study with National Park Service found a variety of human-use contaminants (e.g., pharmaceuticals, personal care products, insect repellants) are brought into Congaree National Park by river waters from upstream urban and agricultural sources, but also found some of these contaminants in backcountry lakes that originated from human activities at the lakes.
- Another study showed that perfluorinated compounds (PFAS; contaminants of emerging concern in drinking water all over the United States) released into ground water from fire-fighting foam and an old underground wastewater plume can persist for decades. This work was made possible because the USGS has been studying this site (a former military base in Cape Cod, MA) for 30+ years, in collaboration with DOD and the state of MA.

### ***Mercury Pathways to Humans and Wildlife***

In FY 2017, a series of studies co-funded by the EHMA and the USGS Ecosystems Mission Area provided a comprehensive assessment across the western United States of the distribution and biological uptake of atmospheric mercury from multiple human and natural sources. A study that provided policy makers with crucial insights into new strategies to help decrease fish and wildlife exposures to mercury in the Great Lakes was also completed. Using unique isotopic mercury analyses on lake sediments, EHMA scientists are able to discern various source contributions of environmental mercury.

### ***Tap Water Quality***

In FY 2017, the EHMA set up a first-of-its-kind collaboration with Federal health agencies, academia, local health groups, and local



*Figure 2: Little girl drinking tap water. Credit: USGS.*

water managers in East Chicago to analyze a broad spectrum of regulated and unregulated potential pathogens and contaminants from municipal drinking water treatment plants, and water from the same plants taken from taps in homes and businesses. This sampling is being conducted in collaboration with a health cohort study of residents in East Chicago and lead by University of Chicago. This effort will help local stakeholders and the public understand what, if any, changes in tap water quality can occur after treatment but prior to the tap in homes and businesses, the role played by point-of-use filtration in homes, and the potential health hazards that any contaminants or pathogens found may pose. No other Federal agencies or non-Federal entities are systematically examining water quality following municipal water treatment but before it reaches the tap.

### ***Actual vs. Perceived Risks of Resource Development Byproducts***

In FY 2017, the EHMA continued to provide non-regulatory, non-advocacy science to help understand actual versus perceived environmental and health hazards posed by byproducts from energy and mineral resource development. For example, a study found that trace levels of contaminants from an oil and gas wastewater disposal facility were rapidly diluted downstream to levels below detection. Another study showed that spring water near a uranium mine had elevated uranium concentrations from natural sources not related to mining activities.

### ***Tools to Model and Mitigate the Spread of Avian Influenza***

A study co-funded by EHMA and the Ecosystems Mission Area resulted in the development of a web-based visualization tool that helps researchers and public health officials determine how relations between poultry farm density and waterfowl migration routes affect the threat of avian influenza to people and the poultry industry. Both the private sector and policy makers rely on this information to make informed decisions about managing the spread of this virus, which can pose a significant hazard to agriculture security and human health.

In 2017, USGS scientist Dr. Diann J. Prosser was awarded the Presidential Early Career Award for Scientists and Engineers (PECASE). The PECASE is the highest honor bestowed by the United States Government on science and engineering professionals in the early stages of their independent research careers. Dr. Prosser was recognized for her scientific leadership in developing an international interdisciplinary program to understand the role of wild birds in the spread of lethal avian influenza viruses, and for exceptional outreach to the public and mentoring at the high school through postdoctoral levels. Her research is partially supported by the USGS Contaminant Biology Program



*Figure 3: USGS scientist Dr. Diann J. Prosser examining a ruddy shelduck in China. Dr. Prosser was awarded the Presidential Early Career Award for Scientists and Engineers (PECASE). Credit: J. Takekawa, USGS.*

### ***Understanding How to Lessen Impacts on Native Pollinators Due to Insecticide Usage***

Neonicotinoid insecticides were not detected from root, leaf, or flower tissues associated with native prairie strips planted within agricultural fields, indicating a low likelihood of exposure to native pollinators and other insects visiting these plants. Sites with native prairie strips had lower concentrations of neonicotinoids in groundwater, had less frequent detections of neonicotinoids in

surface water runoff, and rarely had detectable neonicotinoids in soils located at the foot slope of the native prairie strip compared to sites without native prairie strips.

### ***Award-Winning Scientists***

The expertise and impact of EHMA-funded scientists was underscored in FY 2017 when several were the recipients of awards from the White House, Federal Highway Administration, Wildlife Disease Association and American Association of Wildlife Veterinarians, and USEPA.



*Figure 4: Are neonicotinoids a health threat to native pollinators?*

### ***EHMA Communications and Outreach Accomplishments in FY 2017***

EHMA produced more than 40 Science Feature articles on USGS environmental health science that were released through the EHMA Science Features web page, which recorded more than 185,000 hits in calendar year 2017. EHMA produced three issues of its GeoHealth Newsletter, which has more than 1,600 subscribers from across Federal, State, and local governments, academia, and the private sector.

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