



AT THE CENTER

News and Notes from the
Center for Earth and Environmental Science

Spring / Summer 2008

Director's Note

The faculty, staff, and students of CEES are working diligently to make a positive impact on our Central Indiana environment on many fronts be it in research, education, or public service. We are continuing to expand upon our water resources and algal research with new projects and collaborations locally, nationally, and abroad. We are in full swing for the field sampling season and are looking forward to the new data collected on our Central Indiana streams and reservoirs. Look for updates on field work in our next newsletter. We will have a new staff person joining the team in July, Nicolas Clercin of France, who will be working on algal research studies as a Research Scientist. Our education and outreach efforts have been recognized through a recent grant from the National Science Foundation that is funding graduate student fellows to work with the Discovering the Science of the Environment program in addition to other School of Science Departments and Medicine. CEES has also taken the lead on organizing a new campus sustainability initiative to further efforts on our urban campus to promote environmentally responsible practices.

I hope you enjoy reading about our recent work and updates. Please stay in touch.

Regards,

Lenore P. Tedesco, Director

CIWRP 2008 Research Project

Blue-Green Algae Dynamics and Algal Toxicity: A Study of Central Indiana Reservoirs

Following the documentation of toxic blue-green algae and an algal toxin in Geist Reservoir last year, CIWRP research into blue-green algae has been expanded into a comprehensive research program for 2008. Last summer, blue-green algae concentrations in both Eagle Creek and Geist Reservoirs, and the detection of microcystin toxin in Geist Reservoir resulted in recreational usage advisories being posted by the Indiana State Department of Health for both reservoirs. While the 2007 summer drought conditions created unusual conditions very favorable for the proliferation of blue-green algae, potentially toxic blue-green algae blooms have been occurring in central Indiana reservoirs for several years. In fact, there have been documented cases of blooms of potentially toxic blue-green algae in several areas of Indiana since 2001. Further, a review of blue-green algae research throughout the Midwest indicates that blue-green algae blooms and the occurrence of algal toxins, especially microcystin, are becoming increasingly common in midcontinent lakes and reservoirs.

For years, CIWRP research has focused on understanding phytoplankton (typically microscopic floating plants) occurrence and dynamics in area reservoirs because several types cause taste and odor in finished drinking water. These compounds are likely familiar to you as the earthy and/or musty smell and taste sometimes present in drinking water. Nuisance algal blooms of taste and odor producing phytoplankton have been documented in Eagle Creek, Geist and Morse Reservoirs since at least 2000. In recent years, concern regarding the production and occurrence of blue-green algal toxins has grown in central Indiana and nationally. Evaluation of phytoplankton community structure information from Eagle Creek, Geist and Morse Reservoirs has shown that potentially toxic blue-green algae comprise important parts of the phytoplankton communities in mid-late summer and fall in all three reservoirs. Additional reports of potentially toxic blue-green algae in Indiana include Ball Lake in Steuben County, Lake Lemon and Monroe Reservoir in Monroe County, and at least 20 other lakes and reservoirs statewide.

Given the importance of the central Indiana reservoirs for the drinking water supply and their recreational use, a comprehensive study of the phytoplankton ecology of the three reservoirs is being undertaken. Additionally, documenting the occurrence of taste and odor

compounds (MIB and geosmin) as well as blue-green algae toxin occurrence will be an important part of the study and will be undertaken during the spring, summer, and fall of 2008, and potentially 2009.

CEES is partnering with both Veolia Water Indianapolis, LLC. through the CIWRP partnership, and with the State of Indiana (Indiana Department of Natural Resources, Indiana Department of Environmental Management and Indiana State Department of Health) to conduct these studies. CIWRP funding will be the dominant funding source and will document reservoir physical and chemical conditions, algal community dynamics, taste and odor compounds, and some toxin analyses. The State of Indiana will provide limited funding for additional algal toxin analyses predominantly for Geist Reservoir with some additional analyses of Eagle Creek and Morse Reservoirs. Specifically, CEES will collect samples for algal toxin analyses and results will be provided to the State for dissemination to the public via their website at www.algae.in.gov. CEES will not make recommendations to the public regarding health and safety associated with the use of recreational waters. The State will provide additional information to the public on their website. CEES will continue to provide science-based information about blue-green algae and our understanding of the causes and conditions that help promote algal blooms as they become available.

This study is one of the first studies in Indiana that will document the occurrence of algal toxins on a biweekly basis throughout the growing season. While there have been isolated tests for algal toxins on a few select lakes and reservoirs in response to a bloom or as part of a state-wide screening for one specific algal toxin, this study will provide important comprehensive information to help assess blue-green algal occurrence and reservoir conditions that might be responsible for blooms and toxin production.

CIWRP research and the expertise of CEES researchers (especially Tedesco, Clercin, Pascual, and new graduate student Angie Cowan) continue to provide important information and analyses. Our work has been important in that we have been able to provide information to state agencies, the Indiana legislature, Veolia Water, and the general public. We hope to be able to provide solid science data to the public policy arena as Indiana works to set standards and develop policies for advisories and determine if there is a need for statewide monitoring. We have posted some background information about blue-green algae on our website as well as presentations made at a public meeting for Geist residents. We will continue to provide updates and information as we learn more about our water resources and ways to improve, enhance, and protect them.



Campus Sustainability Initiative

IUPUI formally adopted the Statement of Sustainability Principles for campus life and operations on April 22, 2008. CEES has been coordinating efforts through the Campus Sustainability Initiative committee to integrate sustainability practices across campus. IUPUI schools and departments have a long history of working on components related to sustainability including renewable energy and fuel cells, environmental research, urban planning, greenways, recycling and green building construction. This initiative brings together faculty, staff, and students to promote existing programs and provide suggestions for new directions. Committees are now organizing priority projects in the areas of Built Environment; Energy and Utility Management; Land, Air and Water Management; Public Health; Recycling and Waste Reduction; and Transportation. To review projects and documents or to sign up to get involved, please visit the Campus Sustainability Initiative Web Site at: <http://www.sustainable.iupui.edu/>.



National Science Foundation GK-12 Scholars Program

The IUPUI School of Science and IU School of Medicine recently received funding from the National Science Foundation Graduate Teaching Fellows in K-12 Education (GK-12) program. This grant allows the schools to send 11 research graduate students in math, science, or medicine into area middle or high school classrooms and outdoor labs for each of the next five years. The fellows will work with teachers and students in grades 6-12 for 10 hours per week, while also conducting research towards a Master's or Ph.D. Degree.

The Discovering the Science of the Environment program will benefit from the addition of three Master's level fellows during the 2008-2009 academic year to assist with curriculum development and teaching in the field with the mobile trailer program. The graduate fellows will apply their university, laboratory research projects to classroom and outdoor learning lab programs, offering area teachers and students access to current and relevant science concepts. To learn more about the program, visit: <http://www.nsfgek12.org/>.

Discovering the Science of the Environment

Narrowly avoiding the early spring rains in March, Discovering the Science of the Environment (DSE) entered its second season of onsite environmental science education programming with a fully scheduled two months! Beginning the season at Indian Creek Middle School in Trafalgar, Indiana 6th, 7th and 8th grade science students spent time studying and measuring soil properties, investigating the connection between a healthy ecosystem and biodiversity, and monitoring trees in their ecologically diverse woodland outdoor laboratory.

Several weeks throughout the season were spent at the International School of Indiana, Craig Middle School, and Clay Middle School where 5th and 6th grade students participated in wetland chemical water quality studies, physical, chemical and biological water quality monitoring of a local onsite stream, and wetland ecosystem investigations and soil studies, respectively. Visiting the IUPUI Lilly ARBOR site, 11th and 12th grade environmental science students from George Washington Community School completed chemical water quality studies of the White River, analyzed the groundwater in the restoration area and compared biodiversity at the restoration site with that of a typical lawn.

The season continued with students from the Eastern Greene School Corporation revisiting the Goose Pond Fish and Wildlife Area just outside Linton, Indiana to build upon their first DSE program last October. This spring, students investigated chemical water quality at two different sites – a large restored wetland a small acid mine drainage ditch, joined Brad Feaster from the Indiana DNR in creating two more invasive species monitoring plots, and exploring the wetland with Maggie Sullivan from the Sycamore Land Trust looking for biological life.

Rounding out the spring programming season, the DSE trailer traveled to Forest Glen Elementary working with and preparing 5th grade students to teach community members how to digitally collect and upload soil and tree monitoring data during their Spring Wildlife Festival. We spent the final week of the season at New Augusta North working with all 6th grade science classes to collect and analyze chemical water quality data from a small onsite vegetated stream channel. It was a wonderful spring season filled with outdoor science exploration, technology, data collection, and environmental stewardship. To see photos of the Discovering the Science of the Environmental programs, please visit the photo gallery at: <http://www.cees.iupui.edu/Education/DSE/images/Images.htm>.



Graduate Student Updates - Nutrient Export Dynamics in a Large Central Indiana Watershed

Joseph Johnstone, MS Student / Dr. Philippe Vidon, Advisor

The nutrients nitrogen and phosphorus are water pollutants, and contribute to water quality issues such as eutrophication and the hypoxic or dead zone in the Gulf of Mexico. Midwestern watersheds have been shown to be a major source of these contaminants because of the intensive nature of agriculture. Previous Midwestern studies on nutrient export have focused on net export to large stream systems. However, previous CIWRP research, in addition to other work, has shown that the export of these nutrients during storms is significantly higher than during dryer periods. In fact, up to 80% of the nutrients can be transported during only two or three storms in a given year. My project focuses on examining the patterns of the export of these nutrients during storms on a larger watershed, and seeing how they compare to work done on two smaller nearby watersheds. This detailed work will help identify the mechanisms of transport to the streams (for example overland flow, shallow groundwater, or through tile drains). Hopefully this can assist in the development of improved management practices to minimize this problem as well as help provide better controls for modeling efforts.

Michael Stouder, MS Student / Dr. Lenore Tedesco, Advisor

My research is a continuation of the work related to the Central Indiana Water Resources Partnership (CIWRP) and includes an investigation of nutrient export dynamics in a large-scale watershed surrounded by an agriculturally dominated land usage. Nutrients such as nitrogen and phosphorus are commonly found in substances applied to these areas as they increase productivity and therefore maximize crop yields. However, when transported to bodies of water they can become detrimental to both water quality and aquatic habitats.

My site lies at the intersection of the White River and 146th Street in Carmel, IN which drains an approximate area of 2,360 km². Sampling is conducted during storm events, as a majority of nutrients are transported during these periods of elevated flow. Objectives of this study include 1) tracking changes in concentration and fluctuations of the nutrients during these events, 2) developing an understanding of the timing of peak concentrations as they relate to stream discharge levels in order to aid in more effective water management practices, and 3) using nutrient data, in addition to various cations and $\delta^{18}\text{O}$ levels, to determine water/nutrient flow pathways in addition to pre-event water contributions to the streams. These results will be compared with those obtained by similar studies carried out in smaller watersheds that lie in the Upper White River Basin. In addition to a focus on nutrient transport pathways, CIWRP researchers are also collecting data on the transport of a suite of pesticides, waste water compounds and some so called emerging contaminants. This data may also become part of my research project.

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