



## AT THE CENTER

News and Notes from the  
Center for Earth and Environmental Science

Fall / Winter 2006

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### *Director's Note*

CEES' environmental research, education, outreach, and service learning programs are continuing to expand to reach broader audiences through Central Indiana and beyond. This fall we led tours for high school students participating in the National FFA convention and successfully completed two Water Quality Awareness Day events with the Eagle Creek Watershed Alliance. Research projects from the Central Indiana Water Resources Partnership (CIWRP), the Eagle Creek Watershed Alliance, and the new USDA Conservation Effects Assessment Project (CEAP) are providing valuable information to research scientists, land managers, government officials, and the community on water resources and land management strategies. Students in my wetlands class are conducting baseline research at the new IDNR Goose Pond Fish and Wildlife Area that we hope will form the foundation for new research programs. The Discovering the Science of the Environment program is gaining momentum and is on target for full implementation in the coming summer and fall months of 2007. We look forward to contributing to the advancement, spread, and excitement of science and technology instruction through new and innovative programs. The environmental service learning program is wrapping up a successful semester of engaging hundreds of university undergraduate students and community volunteers and partners in environmental stewardship activities such as invasive exotic species removal, native plant installation, and storm drain marking within community parks and natural areas. In this issue of *At the Center* we have highlighted our recent successes and endeavors and are introducing and welcoming a new staff person, Eileen Hack, as the Research Project Coordinator managing the Eagle Creek Watershed Alliance. As always, please contact us with questions or to become involved in our programs. We welcome your participation!



Goose Pond Fish and Wildlife Area- Linton, IN

Regards,

Lenore P. Tedesco, Director

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### *Friends of CEES*

The success of CEES' programs are enhanced through the continued support from our friends and partners. Through funding from our Friends of CEES program, we are able to provide education opportunities for Central Indiana youth, engage university students and community volunteers in environmental stewardship programs through service learning, and provide internship opportunities for undergraduate science students. The benefit these students receive in the experiences and knowledge gained from engaging in real-world environmental solutions also benefits the community at large. The youth of today will become the decision makers of tomorrow.

We invite you to join Friends of CEES with a tax-deductible contribution. Friends enjoy benefits such as research and outreach site tours and notices of upcoming events and conferences. Please find enclosed in the newsletter a mail back envelope with a contribution form. We appreciate your engagement and support of our programs that educate about and encourage environmental stewardship for all age levels. To learn more about CEES or the Friends of CEES program, you can email us at [cees@iupui.edu](mailto:cees@iupui.edu) or visit [www.cees.iupui.edu](http://www.cees.iupui.edu).

*Sign up to become a Friend and help ensure CEES programs remain an important part of environmental stewardship for Central Indiana.*

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## *Discovering the Science of the Environment*

The Discovering the Science of the Environment (DSE) program is creating numerous partnerships and opportunities to bring environmental science and technology curriculum and activities to 8-14 year old children, educators, families, and the general public in Central Indiana. CEES is partnering with the University of Wisconsin-Madison Arboretum to be one of four national facilitating centers for their program entitled Earth Partnership for Schools (EPS). The EPS one-week institute and corresponding curriculum provide training and activities for teachers in ecosystem restoration to implement, utilize, and maintain outdoor learning environments on school grounds. CEES will host the one week institute for 25 teachers in Indianapolis as part of the DSE program from June 25-29, 2007. CEES is currently adapting the EPS institute and curriculum to Indiana education standards and eco-regions as well as incorporating technology components. Faculty and graduate students from the Indiana University Bloomington Computer Science Department are working with us to create field-based computer hardware and software for use in DSE programs. Faculty from the Indiana University School of Education at IUPUI are working with us to develop a comprehensive assessment program for DSE and are helping with program development to meet the needs of area public schools. We are also working with Project WET (Water Education for Teachers) as a partner to adapt their internationally recognized water quality activities and curriculum for use with the training institute and as modules for site visits with our mobile technology trailer.

CEES is partnering with the Central Indiana Land Trust, Inc. (CILTI) and the Riverside School of Fishers to implement components of the DSE program through the EPS institute and curriculum. The partnership will focus on enhancing environmental studies and implementing ecosystem restoration-based curriculum at the Riverside School as well as for the newly acquired 70-acre CILTI property adjacent to the school grounds. This past summer CEES staff and Riverside School staff attended the two-week Earth Partnership for Schools leadership and facilitation training in Madison, Wisconsin.

We are pleased to announce that the **Nina Mason Pulliam Charitable Trust** and **Dow AgroSciences** have provided funding support to the Discovering the Science of the Environment Program. They join **Veolia Water Indianapolis** and **Eli Lilly and Company Foundation** as supporters. Thank you to all. Visit [www.cees.iupui.edu](http://www.cees.iupui.edu) for DSE progress and program updates.

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### ***Eagle Creek Watershed Alliance Update***

Eileen Hack, CEES Research Project Coordinator

The Eagle Creek Watershed Alliance kicked into high gear this fall. You might have seen the ECWA booth at the Zionsville Fall Festival September 9 and 10. Or you might have been part of Indiana Conservation Alliance "Fall into Nature Days" on September 16, where ECWA offered a boat and bus tour of Eagle Creek Reservoir and watershed. On Friday, September 29<sup>th</sup> 190 5<sup>th</sup> grade students from Zionsville West Middle School participated in a Water Quality Awareness Day festival at Zionsville Lions Park. Citizens had the opportunity to experience some of the festival's water activities at the Saturday, September 30<sup>th</sup> Water Quality Awareness Day at Eagle Creek Park Marina.



CEES Staff Bob Barr and students at Water Quality Awareness Day

Behind the scenes, the Technical Committee developed and is ready to implement a Cost Share Program to fund installation of Best Management Practices in the watershed. A Farm Promoter, housed at Boone County Soil and Water Conservation District, will work with the watershed coordinator and ECWA committees to target locations for Best Management Practices. The Farm Promoter will also educate agricultural producers about the opportunities of the program and provide technical assistance with applying for funds and installation of the BMPs.

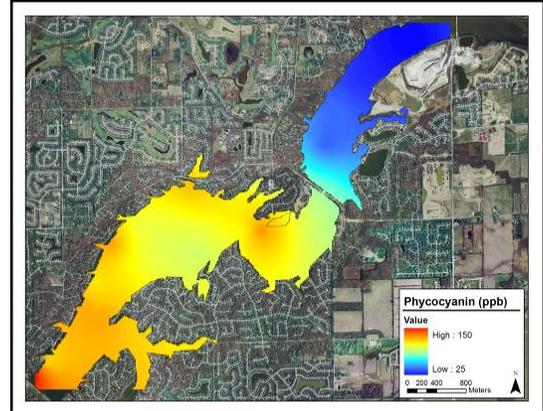
As the new watershed coordinator, I'm impressed with what ECWA has accomplished in a relatively short time, thanks to our wonderful hard-working partners and volunteers. We would like to invite you to help with our efforts to improve water quality and watershed health of this important resource. Please consider joining the Eagle Creek Watershed Alliance and helping us with our efforts. To learn more and to view public meeting schedules and events, please visit <http://www.eaglecreekwatershed.org> or contact Eileen Hack at 317-278-8585 or [hacke@iupui.edu](mailto:hacke@iupui.edu).

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### ***Central Indiana Water Resources Partnership Mapping Blue-Green Algae with Hyperspectral Imagery in Central Indiana Reservoirs***

In 2005, the Central Indiana Water Resources Partnership (CIWRP), the partnership of CEES and Veolia Water Indianapolis, and the Lake and River Enhancement Program of the Indiana Department of Natural Resources funded a research project to develop an assessment tool to map nuisance blue-green algal blooms in Central Indiana reservoirs that are part of the Indianapolis drinking water system. These nuisance and sometimes harmful algal blooms can result in degradation of lakes and reservoirs due to the production of surface scum, earthy smells from taste and odor causing compounds, recreational use degradation, and possibly human health concerns. Using the optical properties of phytoplankton pigments such as chlorophyll *a* and phycocyanin, a pigment unique to blue-green algae, CEES researchers were able to develop methods to rapidly map blue-green algae using light reflectance data. Reflectance data collected both by boat and airplane based sensors on Eagle Creek, Geist, and Morse Reservoirs on have resulted in maps of blue-green algae distribution in all three reservoirs. This assessment tool is currently being tested as a real-time tool for tracking the distribution of blue-green algae in the reservoirs and allowing researchers and managers to better understand how to manage blooms and more effectively target reservoir sampling and treatment.



Interpolated map of phycocyanin distribution (a pigment associated with blue-green algae) in Geist Reservoir on September 6, 2005 based on field sensor data.

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### ***The USDA Conservation Effects Assessment Project (CEAP)***

Purdue University and IUPUI CEES have teamed up to investigate how well various water resource conservation practices work, how much they cost, and how landowners feel about implementing the practices through a project funded with a \$650,000 grant from the USDA's Cooperative State Research, Education and Extension Service (CSREES). The Conservation Effects Assessment Project (CEAP) will concentrate on the Eagle Creek watershed, a major drinking water supply for Indianapolis, to evaluate the long and short-term effects of practices such as tillage, nutrient management, pesticide management, conservation buffers and water management. The project also will study the social and economic factors that affect decisions about water quality management alternatives.

CEES and Veolia Water Indianapolis, through the Central Indiana Water Resources Partnership, have collected and managed historical data and ongoing analysis of the Eagle Creek watershed that will be utilized in CEAP. This information will be used to develop models in order to project the watershed's future and recommend alternative management practices. The analyzed information will be provided to conservation agencies that can then plan and put in place strategies to correct problems. Real data will be used to drive scenario modeling to use in educational programs for policymakers and implementers of best management plans to influence water quality practices in the Eagle Creek watershed.

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### ***Graduate Student Updates***

#### **Kaylan Randolph - Remote Sensing of Phytoplankton Using Optically Active Pigments, Chlorophyll *a* and Phycocyanin**

Nuisance blooms of blue-green algae are seasonally prevalent in Indianapolis' three reservoirs: Geist, Morse, and Eagle Creek Reservoirs. These blooms can lead to aesthetic degradation of drinking water resources (e.g., surface scums on the water and taste and odor in drinking water). Some blue-green algae are able to produce hepatotoxins and neurotoxins, which can lead to adverse human health effects. Current methods for detecting blue-green algae are both costly and time consuming, which can lead to delayed management decisions. However, remote sensing techniques that utilize the optical properties of blue-green algal pigments (chlorophyll *a* and phycocyanin) can meet the need for rapid detection and assessment of blue-green algal distribution. Several previously developed algorithms were applied to boat-collected field reflectance spectra to predict the phytoplankton pigment concentrations in the reservoirs. Preliminary results show that the algorithms are able to predict up to 90% of the variability in phycocyanin concentration and thus blue-green algae distribution. While the algorithms are robust, data will be analyzed to further optimize their applicability to Indianapolis' water reservoirs, thus, providing water quality managers with a survey tool for the rapid delineation and quantification of nuisance blue-green algae.

#### ***Graduate Student Updates, Continued***

## Rebecca Sengpiel – Using Hyperspectral Remote Sensing To Estimate Chlorophyll a and Phycocyanin In Mesotrophic To Eutrophic Indiana Reservoirs

Through funding provided by the Indiana Department of Natural Resources LARE Grant and Veolia Water Indianapolis LLC, Central Indiana Water Resources Partnership, I am working on the development of a more efficient survey tool to determine blue-green algae concentration and spatial distribution in drinking water reservoirs. The approach of my research utilizes the spectral characteristics, i.e. the changes in how light from the sun is absorbed, of Chlorophyll a and Phycocyanin, as captured by the Airborne Imaging Spectrometer for Applications (AISA) airplane based sensor. Chlorophyll a and Phycocyanin are light absorbing pigments that are used by blue-green algae photosynthesis, thus changes in light absorption and reflection indicates the presence of Cyanobacteria. The image data from one of the three reservoirs in the study, Geist Reservoir, has been processed. Preliminary results from this Reservoir have yielded two successful algorithms for the prediction of Chlorophyll a and Phycocyanin. The algorithms can then applied to the data collected to generate high spatial resolution (1 m<sup>2</sup>) maps of Chlorophyll a and phycocyanin distribution in Geist Reservoir. Additional work will also map Morse and Eagle Creek Reservoirs.

## Laura Wagner - Nutrient Specific Flow Paths During Storm Events in a Glaciated, Artificially Drained Landscape

My research objective is to determine variations in nitrate, phosphorus, and dissolved organic carbon concentration in two small watersheds in Eagle Creek watershed during spring and summer storm events and to identify the specific ways these nutrients are moved from the land into streams. Two independent techniques are used to determine the specific flow paths and include use of oxygen isotopes and major cations as change in their concentrations throughout a storm event indicate the water source (precipitation, shallow groundwater, or surface runoff). Identifying changes in water sources during events using these two independent approaches allows for a better characterization of nutrient export processes in the two watersheds. This work will aid in our understanding of nutrient export in agricultural and developing areas of the Midwest that can guide nutrient management decisions to improve water quality.

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### *CEES Conference Updates*

CEES projects have produced several successful research studies and conference presentations. In June, graduate students Kaylan L. Randolph and Rebecca E. Sengpiel presented results from the Remote Sensing Project at the Spring 2006 Indiana Water Resources Association meeting. Both students received awards for Outstanding Student Presentations. In July, Dr. Lenore Tedesco presented research results from her graduate student, Dustin Graham, at the Society of Wetland Scientists in Cairns, Queensland Australia. Fall and winter conference presentations from faculty, staff, and graduate students include:

October 10-14	North American Association for Environmental Education, St. Paul, MN
November 6-9	American Water Resources Association Annual Meeting, Baltimore, MD
November 8-10	North American Lake Management Society Annual Meeting, Indianapolis, IN
November 12-16	Soil Science Society of America, Indianapolis, IN
November 28-30	Innovations in Reducing Nonpoint Source Pollution Conference, Indianapolis, IN
December 4-6	Central Indiana Water Resources Partnership Research Conference, Indianapolis, IN

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### *Contact Us AT THE CENTER*

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