Reservoir Management

Reservoir management is important to the overall quality of drinking water for central Indiana. The research management team includes Dr. Lenore Tedesco, Dr. Pierre-André Jacinthe, and Dr. Gabe Filippelli and research scientists D. Lani Pascual, and Bob E. Hall

Reservoir Assessment and Management Projects

The Relationship between Nutrient Limitation and Nuisance Blue-Green Algal Dominance

Denise Lani Pascual

Research Scientist, CEES

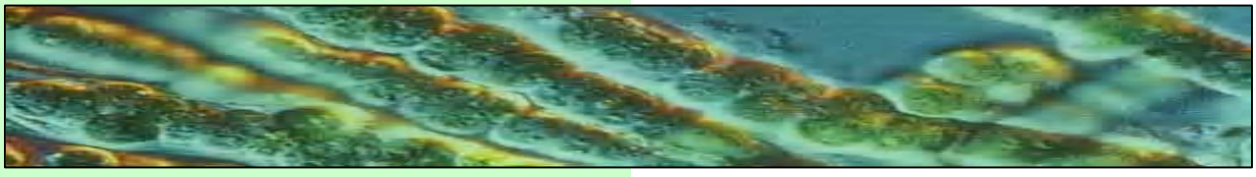
In 2005, Denise Lani Pascual conducted a series of experiments on Eagle Creek Reservoir to measure changes in nutrient dynamics in the reservoir. The experiments were designed to determine if a decrease in nitrogen availability was related to an increase in a specific nuisance alga: filamentous blue-green algae capable of fixing atmospheric nitrogen. These blue-green algae are of particular concern as they have the potential of forming taste and odor compounds and surface scums on water. Some have been shown to cause adverse health affects through the production of toxins. Preliminary data show that Eagle Creek Reservoir undergoes changes from nitrogen abundance to nitrogen scarcity. These changes in nitrogen availability occurred with a change in algal communities, resulting in an increase in nuisance algae. Data from this study confirm the findings of the multi-reservoir survey showing the relationship between nitrogen scarcity and nuisance algae occurrence. Findings demonstrate that predicting and preventing nuisance algal blooms in these small reservoir systems will require managing both nitrogen and phosphorus loads.

Nitrogen Dynamics in Sediment from Three Central Indiana Water Reservoirs

Pierre-Andre Jacinthe, Ph.D.

Assistant Professor, Department of Earth Sciences, IUPUI
Affiliated Faculty, CEES

Nitrate (NO_3^-) is a widespread water pollutant and has been linked to methemoglobinemia, a condition characterized by a reduction in the capacity of infants' red blood cells to carry oxygen. Most of Indianapolis drinking water supply is obtained from stream- and river-fed reservoirs, and these surface water sources are prone to nitrate pollution. In addition to stream inputs, the pool of nitrate in water reservoirs is also related to nitrogen cycling processes in the sediment and to nitrate exchange between the sediment and the water column. Processes controlling nitrate availability in sediment pore-waters include N mineralization (formation of NH_4^+ from organic N),



nitrification (formation of NO_3^- from NH_4^+) and denitrification (conversion of NO_3^- into N gases). To evaluate the potential for reservoir sediment to act as a sink or as source of nitrate to the water column, N transformation processes were assessed using sediment from three water reservoirs near Indianapolis. All the sediment samples exhibited high nitrate removal capacity, but the average rate of denitrification (mg N_2O-N kg^{-1} d^{-1}) in the Geist Reservoir samples (3.6) was 1.5 to 3 times lower than in samples from the Eagle Creek (6.7) and Morse (10.4) reservoirs. Results also showed higher H/C ratio (0.25), respiration rate (51 mg mg CO_2-C kg^{-1} d^{-1}), N mineralization (0.43 mg N kg^{-1} d^{-1}) and nitrification rates (4.5 mg N kg^{-1} d^{-1}) in the Geist Reservoir samples than in samples from the other reservoirs (0.18, 41, 0.12 and 2.2, respectively). These results suggest an imbalance between nitrate-producing and nitrate-removal processes in the Geist Reservoir sediment, and this could result in nitrate transfer from the sediment to the water column in this reservoir. CEES scientists are evaluating the potential effects of this source of nitrate on reservoir dynamics.

Development of Time-Series Models for Water Quality Management in Eagle Creek Reservoir

V. Kelson and J. Wittman

Wittman Hydro Planning Associates, Inc., Adjunct Faculty, Department of Earth Sciences, IUPUI

Eagle Creek Reservoir supplies approximately 15 million gallons per day (MGD) of drinking water to the T. W. Moses water treatment plant. For many years, Indianapolis Water has heard complaints about taste and odor issues related to water from ECR. In recent years, blue-green algae that are capable of producing toxins that may remain in the water column, have been identified, and it has become clear that strategies must be devised for anticipating major algal blooms and mitigating their effects on drinking water quality. To that end, the Central Indiana Water Resources Partnership (CIWRP), has developed a network of 13 monitoring stations within the ECR watershed, including two within the lake, that collect continuous water quality, weather, and lake data. It is expected that these data will allow scientists to characterize the processes taking place within the reservoir and to devise strategies for long–term water quality management.

Although the proximate causes of algal blooms in ECR are not fully understood, in many cases they can be correlated to recent mixing events. ECR exhibits numerous mixing events during the course of the year. Mixing events can release nutrients in the bottom waters into the water column, increasing the possibility of algal blooms. The current monitoring network makes it possible for the scientists at CEES to identify the timing of algal blooms and mixing events, and at least in some cases, to identify the proximate cause of mixing events, e.g. wind stress or inflows from streams.

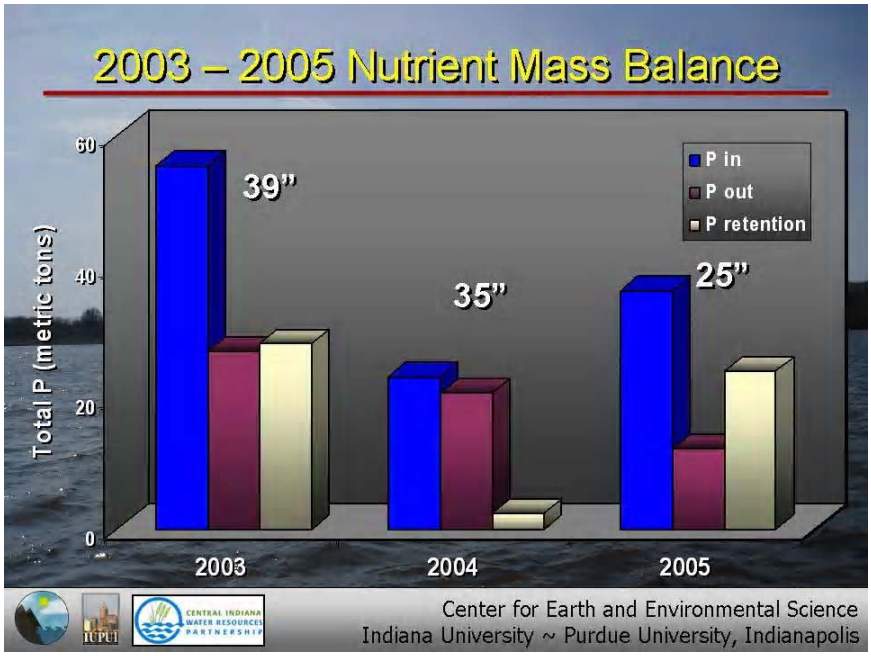
The objective of this project is to find ways to use data from the monitoring network to identify the characteristics of time periods just prior to particular events of interest (e.g. algal blooms or

mixing events), and to devise a strategy for identifying the onset of "pre–event" conditions prior to an algal bloom. This forecasting will be achieved by the application of statistical time–series analyses. Information from the models then can be applied as part of a reservoir water quality management plan.

Three-Year Phosphorus Mass Balance of Eagle Creek Reservoir

Denise Lani Pascual
Research Scientist, CEES

From 2003 to 2005, CIWRP researchers conducted a study to determine the major sources of nutrients – especially phosphorus - to Eagle Creek Reservoir to better understand the supply rates of nutrients that fuel the reservoir's recurring nuisance algal blooms. Over the course of the three years, researchers sampled the inflowing streams to Eagle Creek Reservoir, the water downstream of the dam, the water removed by the drinking water intake, and the reservoir water itself. From these samples, annual phosphorus loads to Eagle Creek Reservoir were estimated and validated using sediment work completed by Master's student Robyn Raftis. The study was able to show that in 2003 and 2005 when rainfall was abundant, the majority of phosphorus in the reservoir came from the watershed via inflowing streams. However, in 2004 when drought conditions persisted through the spring and summer, phosphorus stored in the reservoir sediments was remobilized and drove nuisance algal bloom formation. This finding showed that controlling both external and internal sources of phosphorus will be necessary to control Eagle Creek Reservoir algal blooms. The study contributes to our knowledge about the drivers that lead to nuisance algal blooms and will be used to guide future management decisions to protect and conserve this recreational and drinking water resource.



Phosphorous Fluxes for Eagle Creek Reservoir

Reservoir Assessment and Management Student Research

Internal Phosphorus Cycling in an Urban Drinking Water Reservoir

Robyn Raftis

Masters Candidate, Department of Earth Sciences, IUPUI
Geologist, Office of Land Quality
Indiana Department of Environmental Management

Sediments can provide a detailed history of the evolution of a reservoir, much as tree rings can provide a history of the growth and climatic conditions in a forest. For sediments, this history is extracted by taking core samples through the sediments that have accumulated at the bottom of the reservoir. These cores record the annual layers of sediment that accumulate in the reservoir, providing information about input from rivers, as well as the active biological processes that occur within the reservoir itself. Of interest was the geochemical history recorded from sediment cores in Eagle Creek Reservoir, which would provide information about how patterns have changed since the formation of the reservoir. In particular, we were interested in understanding the role that sediments from the bottom of the reservoir play in nutrient cycles in the reservoir waters. Under conditions of stagnant circulation and warm surface water common late in the summer, nutrients are released into the overlying reservoir water. These excess nutrients may provide nuisance algae with enough nutrients to bloom, degrading water quality and causing taste and odor in drinking water.

We took several complete sediment cores from the bottom of Eagle Creek Reservoir, selecting sites that spanned a range of bottom conditions. We were able to identify the pre-flooding surface within our ~1 meter long cores, and observed that ~65 cm of sediment has accumulated in the bottom of the reservoir since flooding in 1967, amounting to a sediment accumulation rate of about 1.8 cm/yr. The reservoir sediment was typically soft and green-gray colored, being comprised of very fine silt-sized particles and relatively enriched in organic matter (6-14%). Layering was easily observed in the sediment core, likely reflecting seasonal changes in watershed runoff and biological activity.

Eagle Creek Reservoir Sediment Core

The nutrient content of the sediments is very high. For example, the concentration of the biologically limiting nutrient phosphorus is about 1.8 mg/g, putting it in range with other Midwestern reservoirs which also have high biological productivity. One of our key findings was that the percentage of the phosphorus that is highly sensitive to low oxygen conditions was very high (typically about 70% of the total phosphorus content). Because of seasonal patterns in stratification of the reservoir waters themselves, the bottom waters of the reservoir become oxygen-depleted. These low-oxygen reservoir conditions result in the oxygen-sensitive phosphorus in the sediments becoming mobilized and "leaking" back to the reservoir waters. The excess phosphorus becomes available to feed algal blooms and degrades water quality. Thus, the reservoir sediments themselves play a role in the formation of algal blooms. This understanding helps resource managers understand that algal bloom management in Eagle Creek Reservoir will require both watershed management to reduce nutrient inputs from stream flow as well as strategies that manage low-oxygen bottom water conditions.

Water Sampling Eagle Creek Reservoir

Multi-Reservoir Survey Showing the Relationship between Nitrogen Limitation and Nuisance Algal Bloom Formation

Denise Lani Pascual

PhD Candidate, University of Michigan
Research Scientist, CEES

Denise Lani Pascual studied five reservoirs from Indiana and Michigan to determine the relationship between nutrients, nitrogen and phosphorus, and overall reservoir algal growth. Forms of nitrogen (nitrate, nitrite, ammonia, and TKN) and phosphorus (orthoP and TP) as well as chlorophyll *a* (a photosynthetic pigment found in algae) were measured on each reservoir. Data from two Michigan reservoirs, Ford Lake and Belleville Lake were collected from 1998 – 2000, while data from the three Indiana reservoirs, Eagle Creek, Geist, and Morse Reservoirs, were collected from 2005-2006. While phosphorus is often used as an indicator or predictor of overall reservoir health and potential to support exponential growth of algae, these small reservoirs show that the lack of nitrogen in the presence of abundant phosphorus plays an important role in the formation of nuisance blooms of a specific nuisance alga: the *Nostacales* or filamentous blue-green algae capable of

fixing atmospheric nitrogen. *Nostacales* blue-green algae are of particular concern as they have the potential of causing taste and odor in drinking water and forming surface scums. Some have been shown to cause adverse health affects through the production of toxins. Study of these small reservoirs showed that the highest algal cell concentrations occurred when phosphorus availability was high and nitrogen availability was low, showing that decreasing nitrogen-to-phosphorus ratios and the dynamics between nitrogen and phosphorus availability are more important in *Nostacales* bloom formation than nitrogen or phosphorus availability alone. These findings contribute to understanding the drivers of algal bloom formation in these small reservoir systems, informing reservoir and public health managers how to best predict and prevent the occurrence of these potentially harmful blooms.

Floating Enclosures of Zooplankton and Algae Experiments at Eagle Creek Reservoir

Effects of Zooplankton Growth on Nuisance Blue-Green Algae, *Microcystis* and *Anabaena*

Annette Trierweiler

Undergraduate, Furman University

In August 2003, Annette Trierweiler (then a Junior at Park Tudor High School) conducted a set of floating enclosure experiments at Eagle Creek Reservoir. Her study was aimed at understanding the impact of nuisance algae on zooplankton populations, the microscopic animals that graze on the algae, in hopes of using this knowledge to control nuisance blooms on the reservoir. Using floating enclosures, Annette placed Eagle Creek Reservoir zooplankton communities in enclosures with algal populations of two nuisance algae (*Microcystis* and *Anabaena*), which she had cultured in her high school biology lab. Her work showed that zooplankton (such as rotifers and copepods) populations changed in response to the shape of blue-green algae: the smaller rotifers were able to eat the smaller *Microcystis* algae and the larger copepods were able to eat the larger filaments of *Anabaena*. Her work showed that specific zooplankton groups can exert a significant amount of pressure on specific nuisance algal populations; however, this pressure may not be enough to control overall nuisance algal bloom formation in the late summer when blooms usually occur.

Annette Trierweiler won a Grand Award at the 2004 Intel International Science

and Engineering Fair for her research with CEES. Her manuscript is in press with the Proceedings of the Indiana Academy of Sciences and should be published in 2007. Annette is currently a sophomore at Furman University, SC. This winter 2007 term finds her studying abroad, learning the ecology of South Africa and marine ecology of Belize.

Trierweiler, A. and D.L. Pascual (In Press), Zooplankton growth response to the cyanobacteria *Microcystis* and *Anabaena* in Eagle Creek Reservoir, IN. Proceedings of the Indiana Academy of Science.

Ecosystem Restoration

Lilly ARBOR Project Riparian Restoration

The Lilly ARBOR Project, the floodplain forest restoration experiment along the White River in downtown Indianapolis, Indiana, has produced effective methods to restore riverfronts and improve water quality in central Indiana. Since 1999, environmental research scientists from CEES have worked with community partners, university students, and K-12 students and teachers to transform the Lilly ARBOR Project site from mown turf grass into a thriving wildflower, shrub, and sapling forest that is teeming with life.

The Lilly ARBOR Project is testing the best way to restore riverbanks by comparing the three most common methods for planting trees to restore native forests. The data collected each semester allows CEES research scientists to determine whether trends exist for the planting styles used, the species of trees planted, and the location of the trees, among other parameters. Understanding these trends is important to natural resource managers as they develop reforestation strategies locally, regionally and nationally. Additional monitoring programs have developed at the site, which includes plant and animal data collection, as well as ground water and river water monitoring.

Tree Monitoring at the Lilly ARBOR Site, IUPUI Campus

Supported with significant gifts from Eli Lilly and Company and The Rotary Club of Indianapolis, the Lilly ARBOR Project is a model for university-corporate-community collaboration, for the scientific research and design plan actively involves university scientists and students, K-12 students and teachers, as well as corporate and community volunteers. Education outreach activities at the research site focus on science education and technology training and involve thousands of participants.

Results from this research have been published in the journal Ecological Restoration.

Tedesco, L.P., Hernly, F.V., Hall, B.E., Salazar, K.A., Lindsey, G., and Minger, T., 2004, The Lilly ARBOR Project: An experiment in urban riparian restoration (Indiana): *Ecological Restoration*, v. 22, no. 4, p. 294-295.

Remote Monitoring Network at the Lilly ARBOR Project

Water quality and ecosystem monitoring have been at the heart of the Lilly ARBOR Project restoration. With an emphasis on community-based research, the ARBOR project has been a test bed for the utilization of new sensor technologies for monitoring environmental systems remotely.

A collaborative partnership between CEES and the Pervasive Technology Labs at Indiana University has resulted in a series of applied research projects by students at Indiana University Bloomington (IUB). Dr. Lenore Tedesco, working with Drs. Yvonne Rogers and Kay Connelly and students in their courses at IUB, have created wireless, hand-held, data acquisition tools for use at the Lilly ARBOR project. The field tools are designed to enhance learning by closing the gap between field data collecting and laboratory analysis. The tools were implemented for the first time on April 1, 2005 as part of the service learning program at ARBOR that measures the survival and growth of the trees and have undergone several modifications and design improvements and are now part of the data resources used at the ARBOR site for research monitoring.

Wetland Restoration: Scott Starling Nature Sanctuary

This successful restoration of the groundwater fed wetlands at Scott Starling Nature Sanctuary was completed in conjunction with Indy Parks and Recreation Land Stewardship Office. The restoration consisted of removing and disabling hundreds of feet of agricultural tile to restore the hydrology to the site as well as re-establishing over 20,000 native wetland plant plugs since 1999.

Wetland Plantings at Scott Starling Nature Sanctuary, Eagle Creek Watershed

Settled in the mid-1800s, the area on the Westside of Indianapolis was cleared of its natural forest and wetland plants to be converted for farming and other development. By removing the agricultural drainage tiles, CEES is restoring groundwater levels and helping to re-establish areas that were historically a fen and a sedge meadow. Restoring a biologically diverse wetland provides educational, ecological, and economic

benefits including improved water resources, an outdoor laboratory where the dynamics of ecosystems can be observed and taught; and a commitment to environmental preservation and appreciation.

An array of individuals and organizations share CEES' commitment to environmental preservation and appreciation and helped with the Starling wetland restoration and ongoing research and maintenance. Partners include the Efroymson Fund, a donor-advised fund of the Central Indiana Community Foundation, Veolia Water Indianapolis, Spence Restoration Nursery, JF New and Associates, City of Indianapolis Department of Parks and Recreation, Nature Sanctuary and Center, Inc. and IUPUI students and community volunteers.

K-12 Student Research Activities at the Lilly ARBOR Site, White River Watershed

Society has shifted from conquering the environment, to preserving the environment, to restoring the environment.

Yet great questions remain about the sustainability of these restoration efforts.

Ecosystem Restoration Student Research

Riparian Zone Hydrological Functioning in Glacial Till Valleys of the Midwest

Andrew Smith

M.S. Geology, IUPUI, 2007
Geologist, Terracon Inc. Environmental Consultants

Andrew Smith's thesis work in the Department of Earth Sciences at IUPUI at the Scott Starling Nature Sanctuary focused on documenting the water flow systems in the valley and determining the effect of field tile removal on wetland restoration. Given that restoring wetland water conditions remains the most critical factor in successful wetland restoration projects, a detailed study on the hydrology of the Starling site represents an important effort. An important question facing restoration managers is the effect of removing drainage tiles. Does tile removal return the hydrology to pre-disturbance conditions? Or is the effect of the tile drainage always a part of the wetland hydrology? Andrew's work will help answer these questions, in addition to providing a wealth on information about water sources, water quality, and the effect of the wetland on improving the quality of water flowing to Fishback Creek. Andrew found that the Starling fen waters are sourced from seeps in the surrounding bluffs and that during the fall, winter, and spring subsurface water flows from the valley walls towards Fishback Creek, while during the drier summer months subsurface water flows much more slowly and flows down valley towards Eagle Creek Reservoir. This information is important to natural resource managers and CEES as we continue to work on the restoration of the Starling fen system and other natural areas in the Starling Sanctuary.

This research is in the process of being published in the journal Ecological Restoration and in the Journal of the American Water Resources Association.

Ice from Groundwater Seeps in Scott Starling Nature Sanctuary, Eagle Creek Watershed

Assessing the Role of Geologic Setting on Water Quality of Temperate Fens in the Glaciated Midwestern United States

Dustin Graves

M.S. Geology, IUPUI, 2007
Staff Geologist, ATEC Associates

Dustin Graves Master's research in the Department of Earth Sciences at IUPUI consisted of comparing five central Indiana fen systems. Fens are relatively rare groundwater-fed wetland systems. This wetland type is more common in areas north of Indiana. The fens in central Indiana occur very close to their southern limit making documentation of their water chemistry and setting an important contribution to fen protection and restoration. Dustin studied two Indy Parks fens (Southwestway Park and Holliday Park), a fen at Ritchey Woods in the Town of Fishers, and two fens on DNR park properties (Mounds and Prophetstown State Park). These fens all share a similar geologic setting and similar water source, but differ in their size and location relative to human disturbance and surrounding land use. Dustin's work showed that fens have similar water chemistry that can help classify these systems. His work also showed that fen systems at Mounds State Park and Holliday Park show evidence of contamination by road salt. His work is helping natural resource managers understand fen systems and approaches they may use to protect and preserve them.

CEES Field Trip for the US Army Corps of Engineers to the Fen at Southwestway Park, Indianapolis Indiana

Hummingbird Clearwing Moth and Silver Spotted Skipper on Ironweed Flower at Scott Starling Nature Sanctuary

Education and Outreach

Discovering the Science of the Environment

IUPUI Chancellor Charles Bantz, Veolia Water CEO Tim Hewitt, and CEES Director Lenore P. Tedesco at the 2006 IU Foundation's Spirit of Philanthropy Luncheon Honoring Veolia Water for Support of the Discovering the Science of the Environment Program

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. Working with the IU Pervasive Technology Labs, 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 30 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 education activities and curriculum for use with the training institute and as modules for site school 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.

Veolia Water Indianapolis made the lead gift to the DSE program and was recognized at the 2006 IUPUI Spirit of Philanthropy Award ceremony. Additional funding partners include the Nina Mason Pulliam Charitable Trust, Dow AgroSciences, Eli Lilly and Company Foundation, and the Duke Energy Foundation.

Central Indiana Watershed Enhancement Partnership – Expanding Environmental Service Learning and Water Quality Awareness

The Central Indiana Watershed Enhancement Partnership (CIWEP) is a CEES program funded by a Commitment to Excellence grant award from the IUPUI Center for Service and Learning in 2004. CIWEP is focused around raising awareness of ecological health issues as they relate to water quality. The program engages IUPUI students in service learning and internship experiences with campus and community partners to improve water quality and environmental sustainability. CIWEP builds on existing CEES partnerships with corporate, governmental and campus stakeholders (Veolia Water Indianapolis, Indy Parks, IUPUI Campus Facility Services) and builds new partnerships (Fishers Parks and Recreation, Central Indiana Land Trust (CILTI), Hamilton County Parks and Recreation, the Indiana School for the Blind, and Marion County Soil and Water Conservation District) to engage students in environmental stewardship activities while providing service to the community. The goal of this program is to provide education and awareness programs founded in sound and rational science that result in changing behavior to improve the environment – especially water quality.

Storm Drain Markers Installed by CEES Service Learning Students

CEES was named an honorary member of the Clean Streams Team in February 2007.

CIWEP funding allowed for the expansion of the CEES Environmental Service Learning Program. Each semester, we now offer 10-12 community-based environmental stewardship projects for up to 600 students. Some of our most recent projects have included storm drain

marking both on the IUPUI campus and within the community. CEES has partnered with Campus Facility Services (CFS), Veolia Water Indianapolis, and the City of Indianapolis Department of Public Works to locate and mark storm drains which feed directly into local water bodies. The goal of the markers is to promote awareness of the linkage between storm drains and water bodies to prevent pollution and improve water quality of Indianapolis water bodies.

Environmental Service Learning Program

Experiential Learning

Bank Stabilization and Native Plantings at Marott Park, Indianapolis, Indiana

Through the CEES environmental service learning program, IUPUI faculty and staff and community environmental managers work with IUPUI undergraduate students, other Indianapolis-area university students, volunteers, and partnering community agencies to conduct ecological restoration projects on central Indiana public lands. The work days are critical components of the on-going restoration and research of sites within the CEES research network. The projects are conducted 10-12 times per semester with an average of 600 participants per year. Service learning students are introduced to the sites and research objectives and are paired with a research faculty or staff group leader throughout the project. Students then reflect on their experience through a short paper outlining the work day and the relevance to course concepts and environmental stewardship.

Working on these projects provides the students with an opportunity to directly experience many of the topics discussed in their courses as well as to observe community partners and volunteers working collaboratively to address environmental issues. Past service learning participants have commented that they particularly enjoy working with ongoing "real-world" projects. Students and the public are able to access previous years' photos and data on the CEES website to monitor progress of the sites they work in and to distinguish how their work has contributed to the growth and success of the project.

Program Highlights

2003
13 Projects
589 Participants
4 Community Partners

2004
18 Projects
554 Participants
5 Community Partners

2005
25 Projects
706 Participants
8 Community Partners

2006
18 Projects
587 Participants
7 Community Partners

CEES Researchers

Lenore P. Tedesco

Director, CEES; Associate Professor, Dept. of Earth Sciences

Ph.D. Marine Geology & Geophysics, University of Miami, 1991
B.A. Geology, Boston University, 1984

Wetland Ecosystem Restoration, Environmental Education, Sedimentology

Research focuses on wetland restoration including evaluation of restoration strategies and wetland function. This includes studies of urban riparian reforestation, fen wetland restoration, and on the distribution of anthropogenic pollutants. Additional research interests address regional watershed and water quality issues. Dr. Tedesco is working with the Pervasive Technology Labs and CEES staff to develop an autonomous environmental monitoring network measuring water quality throughout central Indiana. Environmental education based on restoration research and environmental monitoring is an important part of her research interests.

Affiliated Faculty

Pauline Baker
Associate Professor
School of Informatics

Ph.D. Computer Science, University of Illinois
M.S. Education, Syracuse University, 1977
B.A. Psychology, Cornell University, 1974

Visual Information Sensing and Computing, Visualization and Interactive Spaces

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Department of Earth Sciences

Ph.D. Earth Sciences, University of California at Santa Cruz, 1994
B.S. Geology, University of California at Santa Cruz, 1986

Biogeochemistry, Paleoceanography, Paleoclimatology, Medical Geology

William Blomquist
Associate Professor of Political Science, Management, and Institutions;
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Ph.D. Indiana University, 1987
M.A. Ohio University, 1979
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Faculty Fellow
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M.S. Biology, Ludwig Maximilians-University, Munich, Germany, 1987

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Pierre-André Jacinthe
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B.S. Agronomy, State University of Haiti, 1985

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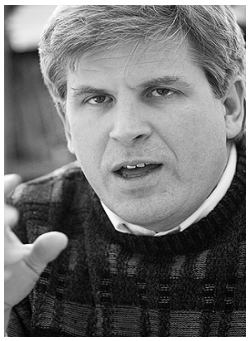
Stephen J. Jay
Professor of Medicine and Public Health
School of Medicine

M.D. Indiana University School of Medicine, 1966
B.S. Wabash College, 1962

Public Health Policy, Environmental Epidemiology



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M.S. Remote Sensing, Institute of Remote Sensing Application, Academy Sinica, 1989
B.A. Geology, Jilin University, China, 1986

Planetary Geology, Environmental Remote Sensing

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Remote Sensing and Geographic Information Science

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M.S. Watershed Science, Utah State University
B.S. Environmental Studies Utah State University

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Robert Barr
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B.A. Geology, IUPUI, 2000
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Wetland Science, Fluvial Geomorphology, Ecosystem Restoration

Eileen Hack
Research Scientist, Project Coordinator
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M.P.H. University of Miami, 1999
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B.S. Biology, College of William and Mary, 1975

Watershed Management, Environmental Education, Aquatic Ecosystem Monitoring and Restoration, Pathogens and Emerging Contaminants

Bob E. Hall
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F. Vincent Hernly
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M.S. Geology, IUPUI, 1997
B.A. Geology, IUPUI, 1992

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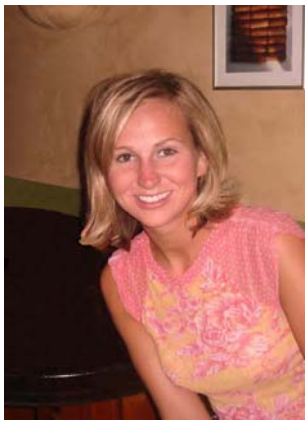
Kara A. Salazar
Research Scientist, Education Outreach Coordinator
CEES

M.P.A. Natural Resource Management and Nonprofit Management, IU, 2002
B.S. Environmental Science and Management, Indiana University, 1999

Environmental Service Learning, Environmental Education, Wetland and Riparian Ecosystem Restoration

Graduate Students



Kate Randolph

M.S. Geography, 2007
B.A. Environmental Management, Indiana University Bloomington, 2002

Remote sensing for water quality. Mapping the concentration and distribution of blue-green algae as tools for improved, efficient water quality management.

M. Abby Campbell

M.S. Candidate, Environmental Geology
B.S. General Studies, IUPUI, 2001

Nutrient and sediment loading of streams under the influence of land use change in Eagle Creek Watershed, Indianapolis, Indiana.

Leda Casey

M.S. Environmental Geology, 2007
B.S. Geology, IUPUI, 2003

Watershed hydrology and the fate and transport of contaminants. The effects of land cover and land use on water quality and nutrient loading to streams, lakes, and reservoirs.

Dustin Graves

M.S. Environmental Geology, 2007
B.S. Geology, University of Southern Indiana, 2003

Water quality related to hydrology and sedimentology. Comparison of water chemistry of source water and evolved water in fens.

Laura Wagner

M.S. Candidate, Environmental Geology
B.S. Geology, Wisconsin, 2004

Nutrient specific flow paths during spring and summer storm events in Eagle Creek Watershed, central Indiana.

Rebecca E. Sengpiel

M.S. Candidate, Environmental Geology
B.S. Geology, University of the Pacific, 2004

Remote sensing for monitoring the distribution of blue-green algae.