NGRREC Faculty Fellows Continue to Focus on Research and Education

by LCCC
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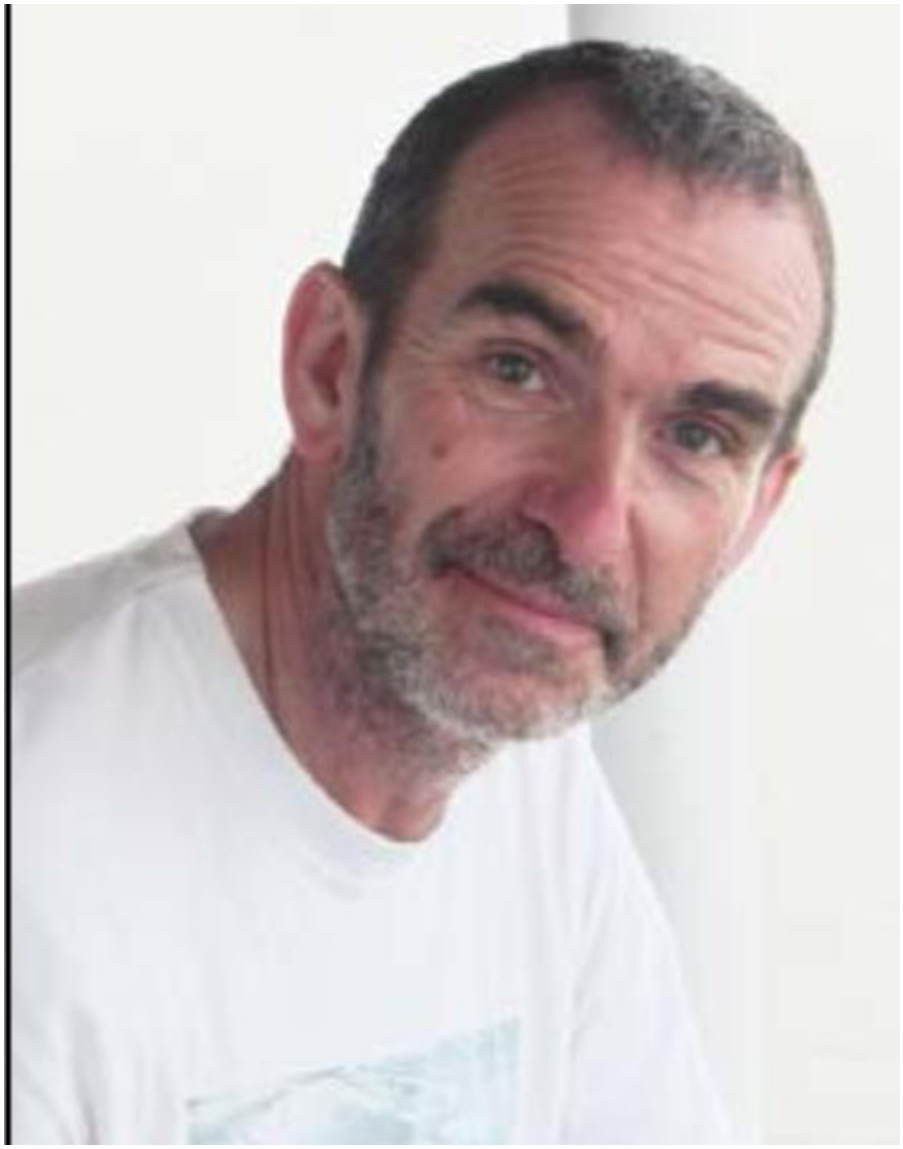
Alton – The National Great Rivers Research and Education Center (NGRREC) has recruited six
scientists to serve as faculty fellows for the 2014-2015 academic year.

The purpose of the Faculty Fellows program is to facilitate collaborations between NGGREC and the
University of Illinois that enhance the center's research mission and that take advantage of its
infrastructure.

The chosen scientists are helping to set the stage for ongoing learning, discovery and engagement at NGRREC, which is an innovative center for research, education and outreach located near the confluence of the Mississippi, Missouri and Illinois rivers in East Alton, Ill.

The following University of Illinois faculty members are currently serving as faculty fellows for the
2014-2015 academic school year: James L. Best, Mark B. David, Angela D. Kent, Jeffrey W.

Matthews, Wendy H. Yang and Bruce L. Rhoads.



Best is a professor of Sedimentary Geology and Professor of Geography and also holds affiliate
positions in Civil and Environmental Engineering and Mechanical Science and Engineering. He has interests in the geomorphology, sedimentology, management and ecology of large rivers and has worked on the Parana, Paraguay, Brahmaputra, Mekong, Mississippi and Columbia Rivers.

As a faculty fellow, Best is investigating the links between bedform migration and preserved stratification in the Mississippi River. His research will also involve field experience for a senior undergraduate student.

Additionally, Best is organizing a colloquium series entitled “The Future of Big Rivers: Form, Flux, Ecology and Management,” consisting of five speakers that will run into

2015. He also plans two visits to conduct research on the Amazon and Yellow Rivers.

“My interests are how we can use knowledge of the morphodynamics of some of the world’s biggest rivers to guide and inform our interpretations of both ancient sediments and future change in modern rivers in response to environmental stresses” Best said. “I also hope facilitating the colloquium series and visiting new possible collaborators will help serve the mission of gaining international recognition for NGRREC and its goals.”

David is a professor in the Department of Natural Resources and Environmental Sciences and has been a faculty member at the U of I since 1985. His research is focused on the biogeochemistry of nutrients in agricultural, forested, and aquatic

ecosystems. He has conducted interdisciplinary research to study complex systems from a variety of approaches.

David’s recent and current research program examines agricultural and aquatic biogeochemistry of nitrogen and phosphorus, including linkages between agricultural and aquatic systems.

As a faculty fellow, David plans to utilize state-of-the-art nutrient monitoring sensors in rivers to better understand nutrient transport and delivery downstream, working closely with NGRREC scientists. This will
help to develop control strategies that can effectively reduce nutrient losses from agricultural fields.

“NGRREC has the equipment and collaborating scientists to deploy, test, and utilize sensors for measuring nitrate and phosphate on a continuous basis in river systems of Illinois,” David said. “This new continuous nutrient monitoring will build on our more than 20 years of river monitoring in Illinois and provide data during large flow

events that we have never been able to previously obtain.”

Kent is a professor in the Department of Natural Resources and Environmental Sciences. While researching microbial ecology, she has interacted with soil scientists, plant biologists, restoration ecologists, aquatic ecologists, engineers, landscape ecologists and social scientists to put her research into a broader perspective.

Kent sees the need to better understand how soil microbial communities respond to land use changes and floodplain restoration. As a faculty fellow, Kent will examine the dynamics of microbial communities in restored and natural floodplain wetlands and the importance of these dynamics in structuring wetland ecosystems and ecosystem services.

“Floodplain ecosystems provide valuable ecosystem services, but extensive land use change over the past two centuries has resulted in extensive loss of floodplain acreage

and ecosystem services, particularly in the Mississippi River basin," Kent said. "My objectives as an NGRREC Faculty Fellow are to evaluate trajectories of change in microbial communities and their functions in wetlands throughout Illinois, to ultimately better understand the ecological drivers that shape microbial communities and their important ecosystem services in floodplains."

Matthews is an assistant professor of natural resources and environmental sciences. His long-term research objectives are to develop models to better predict wetland restoration outcomes and to develop a framework for establishing realistic restoration goals in the face of a rapidly changing global environment.

“Ecological resilience refers to the amount of disturbance necessary to change the state of an ecosystem,” Matthews said. “Resilient ecosystems are better able to absorb the effects of natural disturbances, like fires and floods, as well as human-caused disturbances. Understanding the factors that impart resilience in floodplain ecosystems is important for ecological restoration and for anticipating and mitigating the impacts of global change.”

As a faculty fellow, he is working with other NGRREC fellows to quantify the resilience of restored floodplain wetlands to flood disturbance and evaluate wetland restoration in flood-impacted
landscapes on the floodplain of Mississippi River.

“We are assessing how plant and microbial communities and ecological functions respond to experimentally imposed flooding,” he said. “These responses may be dependent on both the maturity
of the wetland, i.e. the time since it was restored, and the hydrologic history experienced by the biota

at the site.”

Yang is a professor of plant biology and geology, who is interested in determining the controls on fates of nitrate in soils, whether the nitrate is denitrified to nitrous oxide or dinitrogen, retained in the ecosystem via dissimilatory nitrate reduction to ammonium, or passed on to waterways via leaching and runoff.

“The amount of nitrogen lost from terrestrial ecosystems as dinitrogen is a great uncertainty in regional nitrogen budgets because it is notoriously difficult to measure soil dinitrogen emissions against the high background atmospheric dinitrogen concentration of 78 percent,” Yang said.

As a faculty fellow, Yang is probing the fate of nitrate in agricultural soils, including nitrogen cycling processes and the export of nitrate to streams and rivers. A mechanistic understanding of soil nitrogen transformations can inform land management practices to improve water quality and reduce soil greenhouse emissions.

“My measurements will help fill this critical gap in knowledge and go one step further by improving our understanding of the controls on the relative amounts of nitrous oxide, a potent greenhouse gas, and dinitrogen, an inert gas, released by denitrification,” she said.

Rhoads is a professor of geography and geographic information science. He also served as a faculty fellow for the 2013-2014 academic year and currently serves as faculty coordinator for the faculty fellows program.

During his first term as a faculty fellow, Rhoads participated in proposals resulting in two funded projects related to the activities and goals of NGRREC.

The first project, funded by the National Science Foundation, is a major, multi-university initiative to establish a Critical Zone Observatory focusing on intensively management landscapes in the agricultural Midwest (IMLCZO).

The project, led in part by faculty at the University of Illinois, also involves scientists from the University of Tennessee, Indiana University, University of Iowa, University of Minnesota, Northwestern University and Purdue University. The observatory centers around the exploration of water, sediment, and biogeochemical fluxes with the "critical zone," the portion of the Earth environment extending from the top of the tree canopy to beneath the soil.

Rhoads is helping to lead the effort to measure water, sediment and nutrient fluxes in the upper Sangamon River basin in Illinois, one of three watersheds that comprise the IML-CZO. NGRREC is a partner in this project and will play an important role in education and outreach to disseminate results of the study to students, educators, policy makers and the public.

"The IML-CZO represents an important opportunity to improve our understanding of human – environment interaction in the Midwest and how we can work within the framework of this interaction to achieve goals of sustainability, including agricultural productivity and environmental quality," Rhoads said.

"The collaboration with environmental educators at NGRREC to help translate and communicate results to educators and policy makers is vital to the success of this major project."

Rhoads has also obtained funding from the National Science Foundation to support research on mixing at stream and river confluences. He is the lead investigator on this project, but is collaborating with a scientist at the University of Iowa, and also with colleagues at the Institute of Freshwater Ecology in Berlin, who have obtained funding from the German Research Foundation for a companion study. This project includes NGRREC as a partner on educational outreach.

Rhoads is examining mixing at the confluence of the Missouri and Mississippi Rivers near the NGRREC Jerry F. Costello Confluence Field Station using satellite remote sensing. This new project is focused on field experiments to determine the factors controlling rates of mixing at small stream confluences. Mixing at confluences is

important because rivers with different water quality conditions combine at these locations, Rhoads said.

The National Great Rivers Research and Education Center is a partnership of Lewis and Clark Community College, the University of Illinois at Urbana-Champaign and the Prairie Research Institute's Illinois Natural History Survey.NGRREC is situated in a unique position near a significant yet relatively unstudied ecosystem created by the confluence of the three rivers. Few ecosystems are as closely linked with the development of human civilization as great rivers, and few ecosystems have been as greatly altered by
humans.

Sustaining both the ecological and economic health of the Mississippi and other great rivers requires
research that addresses critical areas such as invasive species effects on native biota, habitat restoration, nutrient fluxes and strategies to reduce inputs to marine systems.

NGRREC's scholars and scientists study the ecology of the big rivers, the workings of the watersheds that feed them, and ties to the river communities that use them. NGRREC aspires to be a leader in scholarly research, education and outreach related to the interconnectedness of big rivers, their floodplains and watersheds, and their associated communities.

For more information about NGRREC visit www.ngrrec.org.