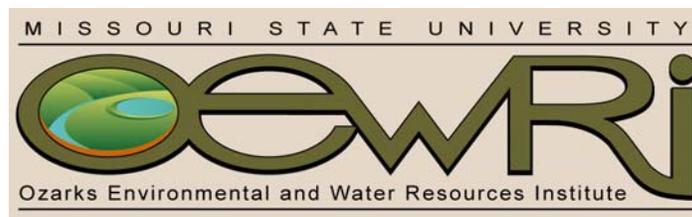




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Ozarks Environmental and Water Resources Institute
Mission and Activities for 2007



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This report presents the mission and 2007 activities for the Ozarks Environmental and Water Resources Institute (OEWRi) in the College of Natural and Applied Sciences (CNAS) at Missouri State University (MSU). The report is organized in the following manner:

- (1) Description of the mission statement, advisory board, and facilities;
- (2) Description of activities for 2007
- (3) Accomplishments in research, education and student involvement, service, and outreach

Additional information about OEWRi can be found at <http://www.owri.missouristate.edu/>.

MISSION OF OEWRI

History and Purpose

Missouri State University's Board of Governors established the Ozarks Environmental and Water Resources Institute (OEWRI) in January 2004 to address water resource issues within the Ozarks through research, education, and outreach. Funding to start the institute included a \$1,000,000 federal appropriation through the support of Senators Bond and Talent and Representative Blunt in 2006-07 and base support by the University of \$75,000 annually. Federal funding was targeted to develop the infrastructure and capacity for research in three areas identified as important to meet the needs for management of water resources and watersheds in the Ozarks: water quality and quantity, sedimentation and soil/sediment quality, and geospatial analysis of land use and natural resources. The Ozarks region covers the southern half of Missouri, northern Arkansas, and parts of northeastern Oklahoma and southeastern Kansas. However, some research and outreach activities extend outside the region in support of the goal to achieve national recognition by 2010.

Regional Concerns

Our present understanding of hydrology, water quality, soil disturbance, and contaminant transport in Ozark watersheds is insufficient to develop effective water quality models, land management plans, and conservation practices. Polluted runoff and sediment released by urban areas, construction activities, agricultural operations, and historical and present-day mining threatens pristine water supplies and sensitive ecosystems. Karst limestone plateaus with abundant sinkholes, caves, and springs can quickly convey runoff and contaminants to groundwater supplies. In particular, questions have been raised over how recent growth in urban areas and agricultural industries is affecting water quality and supply in southwest Missouri and northwest Arkansas. Indeed, ground water levels in the western Ozarks are dropping at an alarming rate and threaten the livelihood of residents. Additionally, there are questions about the effects of large-scale river management on water quality, channel stability, and ecological health. Thirteen reservoirs have been constructed over the past 90 years for the purpose of power generation, flood control, water supply, and recreation in the Ozarks.

It has long been recognized that the streams and lakes in the Ozarks provide economic and quality-of-life benefits that need to be protected and managed for the long-term. Statewide assessments by government agencies indicate that resource extraction, agriculture, urban development, and tourism threaten and/or impair water and soil resources in many areas of the Ozarks. Thus, sustaining economic growth in the Ozarks without compromising water quality and reducing water supplies is the region's defining challenge for the future. OEWRI addresses this challenge by providing a hub for science-based monitoring and assessment of water and sediment quality trends, watershed function and disturbance, and land use/land cover change in southwestern Missouri.

Mission Statement

OEWRI's mission is to advance our scientific understanding of water resource quantity, quality, and distribution in Ozarks watersheds. Centrally located in Springfield, Missouri, OEWRI provides technical expertise, analytical capability, and student training to support environmental research, watershed monitoring programs, and watershed group activities in the Ozarks. It directs and collaborates on research projects aimed at solving water quality and supply problems by working in partnership and cooperation with university researchers, environmental groups, local communities, and government agencies.

OEWRI's mission has four major goals:

- (1) Conduct applied and basic research focusing on understanding the influence of natural processes and human activities on watershed conditions and water resources;
- (2) Establish regional partnerships, disseminate information, and provide educational and training opportunities related to scientific monitoring and management of water resources;
- (3) Provide policy alternatives to address water resource questions raised by decision-makers based on scientific sampling and analytical protocols; and
- (4) Serve as a clearinghouse for research results and publications pertaining to water supply and quality in the Ozarks.

Program Areas

Activities at the institute are primarily focused on the following six program areas:

(1) Water and Sediment Quality Laboratory

Laboratory instrumentation and facilities focus on those water and sediment quality indicators of most concern to researchers, government agencies, and watershed groups in the region. The laboratory has a full-time director and training protocol and follows USEPA-approved standard methods and strict QA/QC procedures. The laboratory can analyze the following water constituents: water chemistry (temperature, pH, DO, SC, turbidity); total suspended solids and settleable solids; nutrients (N, P); IDEXX bacteria counts; bacterial DNA fingerprinting and tracking using Bacteroides PCR assays; metals (Pb, Zn, Cu); total/organic carbon; suspended and benthic chlorophyll/algae; and dissolved ions by ion chromatography. The laboratory offers the following soil/sediment analyses: particle size distribution by laser diffraction, hydrometer, and dry/wet sieving; two sonic sifters; soil pH; total and inorganic carbon; available, extractable, and total trace metals, major elements, mercury, and phosphorus; radioisotope activity (Cs-137, Pb-210); and various standard soil properties including "soil test" analyses.

(2) Geospatial Sciences Laboratory

The Geospatial Sciences Laboratory provides both investigative and analytical assistance to water and sediment quality related projects within the institute. The laboratory houses both field and desktop geospatial analysis equipment. Desktop instrumentation includes seven computer workstations running geospatial software including ArcGIS Desktop 9.2 suite with multiple ArcGIS Desktop extensions including Spatial Analyst, 3D Analyst, Survey Analyst, Geostatistical Analyst, Feature Analyst, and others. Workstations are also equipped with the latest version of the image processing software ENVI, as well as all of the software necessary to communicate with and integrate numerous pieces of geospatial field equipment. Field instrumentation includes three auto level with tripods and stadia rods; two Topcon electronic Total Stations; two Trimble GeoXH mapping grade GPS receivers; two Trimble Zephyr antennas; and three Garmin GPS Map 76 GPS units. In addition, OEWRI partially supports a continuous-logging GPS base station and offers on-line access to correction data. With this combination of field and desktop tools OEWRI can provide a range of cartographic products and geospatial analyses including (i) thematic map production; (ii) database development with on-line access; (iii) watershed assessments of geology, soils, stream networks, riparian lands, land use, and point and nonpoint pollution sources; (iv) topographic stream channel and floodplain surveying and mapping, (v) image interpretation and classification using aerial photography and satellite imagery, and (vi) GPS surveying and ground point control.

(3) Water Quality Monitoring

The Institute is a leader in stream sampling, trend analysis, and water quality data interpretation in southwest Missouri. Through collaboration, contracts, and grants, OEWRI provides expert advice and technical support to watershed groups, local communities, and private businesses to help plan and implement baseline and regulatory water quality monitoring programs. It is equipped to cover a wide range of monitoring services such as 319 watershed projects, TMDL monitoring programs, and catchment runoff studies. In addition, the institute supports an on-line accessible data base for publications and water quality data for the region. Data generated by monitoring efforts are used to develop rating curves to evaluate load-based pollution trends, evaluate the influence of land use on water quality, and support compliance monitoring requirements by state and federal agencies. OEWRI is equipped with three autosamplers, two propeller-type velocity meters, two acoustic velocity meters, four depth-integrated field samplers, and other field sampling supplies.

(4) Stream Stability and Sedimentation

Research on the physical characteristics of streams of all sizes is needed to develop models of channel form and behavior that can be used for management purposes to address bank erosion and sedimentation problems in the Ozarks. OEWRI focuses its physical river research efforts in three areas: channel morphology, long-term channel dynamics, and sediment contaminant dispersal. *Channel morphology* research involves the collection and evaluation of field measurements of the cross-section, longitudinal profile, and planform pattern to understand the present condition of the channel and floodplain. OEWRI uses a combination of quantitative and rapid assessment procedures that have been scientifically tested and developed for use in Ozarks streams. The geomorphic data collected is used to model channel form, determine causes of channel instability, and support channel restoration plans. Investigations of *long-term channel dynamics* involves the detection of changes in channel form, bank erosion, and floodplain sedimentation over periods of 10 to 1,000 years or more. Subsurface investigations and remote sensing methods are used in these studies to understand the response of watersheds and river systems to climate change and historical human disturbances. Finally, for pollution control purposes, it is important to understand processes affecting the spatial trends of *sediment contaminant dispersal* by rivers. Sediment particles can bind metals and nutrients to high concentrations and often become important contributors to water quality problems. Thus, it is important to understand the role played by active channel and floodplain sediments during the storage, transformation, and remobilization of contaminants in Ozarks rivers. OEWRI is equipped with a truck-mounted Giddings coring rig, field surveying equipment, and sediment/soil sampling tools.

(5) Collaborative Environmental Programs

OEWRI collaborates with experts in other fields to address water resources problems in the Ozarks in the fields of urban and agricultural land management, biomonitoring, and water supply vulnerability. OEWRI is involved with efforts to develop effective *soil and water conservation practices* for both urban and agricultural areas in the Ozarks. Urban projects include the evaluation of soil conditions and runoff characteristics for low impact developments, identifying causes of bed and bank erosion in urban streams, and understanding nutrient mobility in residential lawns. Local collaborators on these projects include the James River Basin Partnership and Greene County, Missouri. Agricultural conservation initiatives include a pilot study on the mobility of potential contaminants after field treatments with biosolids and the development of vegetative buffer systems to reduce nutrient runoff from grazing operations and pastures. Collaborators on these projects include the Department of Agriculture at MSU and the City of Springfield.

OEWRI also collaborates with aquatic biologists, limnologists, and microbiologists to use *biomonitoring methods* to evaluate the impacts of natural disturbance and human activities on river and lake biota. The projects involve surveys of macroinvertebrates, mussels, plankton, chlorophyll, and algae in streams and lakes. Biomonitoring surveys are used to compliment water quality studies if information on ecological impacts is

required. In addition, OEWRI supports total-coliform and *E. coli* monitoring activities and microbial source tracking using a Bacteroides PCR assays in Ozark watersheds.

OWRI is involved with ad hoc committees and research initiatives to better understand *water supply vulnerability* in the Ozarks. Population growth and land use change in the region are straining water resources due to water shortages, nonpoint pollution, waste water and septic field releases, and water rights issues. OEWRI is presently involved with several community and regional initiatives to evaluate water supply problems in the southwest Missouri including the role that new infrastructure, conservation, and climate change may play on future supplies and economic growth. In addition, OEWRI is often included on emergency evaluation teams for sinkhole collapse and flood damage in Greene and Christian Counties, Missouri.

(6) Student Training and Research

An important outcome of OEWRI activities is the training and research experience provided to undergraduates and graduate students in geography, geology, planning, biology, chemistry, and business. Last year OEWRI supported 13 undergraduate hourly workers and 11 undergraduate research projects. Also last year, the Institute supported 19 graduate assistants and 11 master thesis projects. In addition, OEWRI staff are an important educational resource to the University because they are accessible to students, have applicable technical expertise, and overlap project involvement with student activities. All students that work on OEWRI projects must complete a structured training program and monitored field or laboratory probationary period prior to the collection or analysis of data for OEWRI projects. Several OEWRI graduate assistants have gone on to jobs in the environmental management field in the Ozarks after graduation.

Advisory Board

OEWRI is administered within the College of Natural and Applied Sciences (CNAS) at Missouri State University. An advisory board with a membership representative of CNAS was formed in October 2007. The board functions to: (i) provide an expertise base for the institute, (ii) communicate and network with department faculty, and (iii) advise the director on activities and concerns. Present membership of the OEWRI Advisory Board includes 14 members:

Richard Biagioni, Chemistry
Lifeng Dong, Physics and Material Science
Ben Fuqua, Director Darr Center & Agriculture (AGR)
Douglas Gouzie, Geography, Geology, and Planning (GGP)
Janice Greene, Director Bull Shoals Field Station & Biology (BIO)
John Havel, BIO
Tammy Jahnke, Dean CNAS
George Mathew, Mathematics (MTH)
Inno Onwueme, Associate Dean CNAS
Bob Pavlowsky, Director OEWRI & GGP
Tom Plymate, Head GGP
Lloyd Smith, Head Computer Science (CSC)
John Steiert, BIO
Gary Webb, AGR

Staffing

OEWRI is staffed on campus in Temple Hall as follows:

- (1) Robert Pavlowsky, PhD., Director, half-time
- (2) Marc Owen, M.S., Research specialist II and project supervisor, Soil Quality, Geomorphology, and Field Monitoring
- (3) Heather Hoggard, M.S., Research specialist II and project supervisor, Water Quality and Laboratory Director
- (4) Derek Martin, M.S., Research Specialist I, Geospatial Technology and Gap Project
- (5) Deana Gibson, secretary and project accounts (shared with Geography, Geology, and Planning)

Facilities

OEWRI facilities are presently located in Temple Hall within office and laboratory space that is under departmental control. The following rooms have been temporarily allocated to OEWRI by the departments until new space becomes available in the future:

Department of Geography, Geology, and Planning

- (1) Director's office- T321;
- (2) Staff and GA offices- T326, T343, and T307;
- (3) Geomorphology Laboratory- T125 (Supervised by Dr. R. Pavlowsky);
- (4) Sample Preparation Laboratory, T129 (shared use area); and
- (5) Caves and Karst laboratory, T329 (Supervised by Dr. D. Gouzie);

Department of Chemistry

- (1) Nutrient laboratory, T470 (Supervised by Dr. R. Biagioni);
- (2) Metals/ICP-AES laboratory, T437 (Supervised by Dr. R. Biagioni); and
- (3) Ion chromatography analysis, T457 (Supervised by Dr. R. Biagioni).

Department of Biology

- (1) Microbiology laboratory- T239 (Supervised by Dr. John Steiert).

ACTIVITIES FOR 2007

OEWRI activities in 2007 focused primarily on the development of research capacity, formation of partnerships, and initiation of new research projects in major program areas (i.e. "start-up") to support science-based monitoring and assessment of water and sediment quality trends, watershed function and disturbance, and land use/land cover change in southwestern Missouri. The main program areas for OEWRI includes its water and sediment quality laboratory, geospatial technology laboratory, field-based water quality monitoring, stream stability and sedimentation investigations, collaborative research in water resources, and student training and research. Beyond breaking new ground, OEWRI also had a number of ongoing projects to work on that included external funding and support for students that took significant amount of time and effort to support. These activities are discussed below.

USEPA “Start-up” Funds

The primary emphasis of OEWRI activities in 2007 centered around working on a major federal “earmark” grant from the U.S. EPA to fund general start-up activities and research projects. OEWRI has until Summer 2010 to complete the following objectives for the grant:

(1) Provide infrastructure and develop office and laboratory space.

This is an ongoing activity depending on research and student support needs. However, the major components of this objective in terms of budget expenditures and utilization of existing space has been met;

(2) Develop facilities, instrumentation, and capacity for scientific water and soil/sediment monitoring and analysis including acquisition of equipment and supplies for water and sediment quality activities.

Equipment acquisition is still on-going but is getting near the end of planned activities for the start-up grant. Costs for the supplies to support the initial installation, calibration, operating procedure development, and operator/staff/student training are still high for these projects.

(3) Develop EPA-approved Quality Assurance Program Plans (QAPPs) and Standard Operating Procedures (SOPs) for all laboratory/analytical, field monitoring, and geospatial techniques.

The funding and time/effort associated with this objective represents a significant activity of OEWRI in 2007 and ongoing operations in this area are required to develop the research capacity and laboratory capability as intended. Published lists of SOPs are on the OEWRI websites and QAPPs need to be developed for all federal and state funded monitoring or research projects.

(4) Inventory and network university-wide resources to provide water and soil/sediment quality monitoring and analytical services for contract work and to support collaborative efforts or matching funds for grants.

This activity is aimed at supplying environmental services and outreach to the community and to allow the marketing of OEWRI capabilities for contract work and student applicants to our graduate programs. Over the next year or two, lists of services and their costs as well as contracting information will be available on the OEWRI website. However, immediate efforts are involved with start-up activities and the staff and instrumentation support for present research projects.

(5) Develop and support environmental and water resource website services including data delivery and communication systems.

The progress on this objective can be found at the following website:
<http://www.owri.missouristate.edu/>

(6) Develop active partnerships with environmental groups, government agencies, or other universities to develop and implement monitoring activities, research projects, or management plans aimed at improving watersheds in the Ozarks.

OEWRI is a leader at MSU on developing partnerships for research and education on campus and in the region. This is a primary and ongoing activity of OEWRI. Descriptions of partnerships are provided later on in the annual report.

(7) Plan and implement four water and sediment quality research projects that address regional water quality concerns as determined by published TMDLs by the state and regional watershed groups and managers.

Funds to support these projects were allocated in September 2007. Descriptions of these projects are described in the next section.

(8). Host and sponsor water research and resources conferences for the Ozarks region.

The first sponsored conference is planned for summer/fall 2008 and will focus on understanding the vulnerability of water supplies of southwest Missouri and offering some potential solutions. This conference will be held in the Joplin area in cooperation with regional environmental groups, communities, and water agencies.

Infrastructure Development

In 2007, several major purchases of analytical instrumentation and other equipment were made by OEWRI:

- (1) Portable XRF elemental analyzer for soil samples (30k);
- (2) Total inorganic carbon/Total organic carbon analyzer for water samples (40k);
- (3) Gamma Spectrometer and Germanium counter for radioisotope measurements in soil samples (45k);
- (4) Ion chromatograph for dissolved ion analyses in water samples (35k);
- (5) Bacterial typing instrument (iPCR) through a biology collaborative project;
- (6) Truck-mounted Giddings soil coring machine with 4x4 truck (50k); and
- (7) Field truck (22k).

On-going Projects

During 2007, OEWRI activities were directed at continued work on projects from 2006. A complete list of these projects is provided later, but four are highlighted below.

(1) James River Stormwater 319 project. This project involves working with the James River Basin Partnership to understand the effect of residential communities in Christian County on runoff water quality and to develop land management demonstration projects that reduce nonpoint pollution loads of nutrients and bacteria to local streams. OEWRI is providing water quality monitoring and analytical expertise and technical assistance for watershed planning and outreach.

(2) Southwest Missouri Water Quality Improvement “GAP” Project. OEWRI is working with the Environmental Resource Coalition, MEC-Water Resources, and University of Missouri-Columbia to evaluate the present availability of water quality data for southwest Missouri and to offer recommendations for improvements in water quality monitoring programs to address present environmental concerns. OEWRI’s main contributions have been in the study of population and discharge trends across the entire region and the completion of specific reports on the James, Spring, and Elk River watersheds.

(3) Bennett’s Spring Water Baseline Water Quality Monitoring Project. In collaboration with the Center for Resource Planning and Management, OEWRI has just completed a year-long water quality monitoring study of the Bennett’s Spring recharge area and Upper Niangua River. Water quality information will be used to develop watershed management alternatives that both protect the water resources of the area and allow for economic growth.

(4) Ward Branch Channel Restoration 319 Project. OEWRI is nearing the completion of a four year long project aimed at reducing sediment and nutrient pollution by using channel stabilization and vegetation buffer techniques in Ward Branch, an urban stream draining southern Springfield. This project was coordinated by Greene County and included collaboration among the City, Missouri Department of Conservation, and, Intuition and Logic, a consulting firm. The results of this project will be used as a foundation to plan other similar projects for the area.

New Projects

Several new projects began in 2007 including:

(1) The second year installment of USEPA start-up funding at 494k (the total two year amount is 990k). This funding is presently funding the beginning of four new field research projects in the James River Basin. The goals of these projects are to carry out water and sediment quality monitoring and research projects to support basic research needs in the Ozarks, watershed initiatives of the USEPA, and water quality goals of the Missouri Department of Natural Resources (MDNR). The proposed projects include:

(a) Pearson Creek Watershed Assessment. A watershed-scale water and sediment study of Pearson Creek will address “unknown” toxicity and nonpoint pollution sources including bacteria, metals, and nutrients to support efforts to develop a Total Maximum Daily Load (TMDL) by 2009. Pearson Creek drains a unique watershed area that contains Jones Spring, urban and rural areas, and urbanizing areas. Water from Pearson Creek flows only a short distance down the James River until it reach the Blackmon water works and Springfield Lake. Sampling sites will be distributed in a manner designed to locate pollution sources and isolate land use effects.

(b) Seasonal and Land Use Variations of Suspended Sediment and Chemical Loads in the James River Basin. This study will quantify the suspended sediment and dissolved loads in the James River by sampling at weekly intervals during dry and wet weather at active USGS gauging station locations. Suspended sediment is ranked by USEPA as the number one nonpoint pollutant nationally, yet we have no understanding of the seasonal variations in loads and their relationship to land use in the southwestern Ozarks. Other total forms and dissolved constituents of nutrients and other ions will also be monitored.

(c) Historical and Present-day Channel Stability of the Finley Creek. This project involves a watershed-scale study of stream bed and bank stability in the Finley Creek. Recent meetings with stakeholders and managers during the development of the management plan for the watershed have identified channel instability and sedimentation as one of the primary problems affecting their watershed. This project will examine channel morphology, riparian vegetation, bank erosion, and gravel bar distribution using historical aerial photography, GIS/remote sensing, field assessments, and subsurface floodplain mapping; and

(d) Alluvial Chronology, Geomorphology, and Contamination of Floodplains in the Middle James River Valley. The study involves the geospatial and subsurface investigation of the properties, distribution, and metal contamination of alluvial deposits in the Middle James River Valley from the Pearson Creek Confluence, through Lake Springfield, past the Wilson Creek confluence, and ending at the Finley Creek confluence. Floodplains act as both a source and sink of sediment and sediment-bound pollutants in river systems. Previous research has identified high levels of metals including lead, zinc, and mercury in floodplain deposits below the historical mining areas on Pearson Creek and in active sediments and floodplains along Wilson Creek. Understanding the landform distribution, age, sediment budget, and contamination distribution will offer insights into the geography and timescales of sedimentation and floodplain erosion and the role that bank erosion plays in supplying sediment and other nonpoint pollutants to Ozark rivers.

(2) Three channel assessment projects through contracts with Olsson Associates (consulting engineers) totaling about 13k.

(3) A National Geographic Research Grant totaling 20k to support the geomorphic study of sediment mercury distribution in North Carolina streams affected by historical gold mining in collaboration with East Carolina

University. During summer 2007, both MSU and ECU students worked together to collect field data for the project along the streams of North Carolina.

(4) Four collaborative aquatic biology projects totaling about 86k.

Student Support for Training and Research

This was a major activity for OEWRI in 2007. OEWRI projects provided graduate assistantships for 19 students in three programs (Biology, Geospatial Science, and Business Administration) in 2007. In addition, the Institute helped support 12 MS thesis projects through technical advice, training, data acquisition, supplies, and instrument use. Lists of these students and their programs are found below.

RESEARCH ACCOMPLISHMENTS

One of the primary goals of OEWRI is to promote and initiate cooperative research projects on water resources issues and water and sediment quality. Three examples of promotion efforts by OEWRI in 2007 are described below:

(1) Incentive grant with Chemistry- As a co-PI, OEWRI submitted a successful research incentive grant with Gary Meints (PI-Chemistry) to purchase and support solid-state nuclear magnetic resonance instrumentation. OEWRI will be involved with Chemistry to do a pilot project on the use of NMR to discriminate among different types of phosphorus compounds in natural and contaminated soils.

(2) Life Sciences Trust Fund research proposals- OEWRI was involved in the submission of two life science proposals in the area of water quality. One was with the Department of Agriculture, Darr Agricultural Center, and Bull Shoals Field Station at MSU to develop a research center at Mountain Grove to study the use of vegetative buffers to reduce runoff contamination to local streams from different grazing systems. The other was with the University of Missouri-Columbia and Watershed Committee of the Ozarks to determine the source and distribution of bacteria contamination in springs located in the Little Sac Watershed. While all parties benefited from the cooperation involved, both proposals were not funded.

(3) Bacteria Source Tracking- Working in collaboration with Dr. John Steiert (BIO), OEWRI is supporting total-coliform and *E. coli* monitoring activities and microbial source tracking using a Bacteroides PCR assays in the Finley Creek and Pearson Creek watersheds. This research is occurring within larger watershed monitoring programs being implemented by OEWRI.

(4) Karst Spring Nutrient Pulses- OEWRI has partially funded Teresa Carroll at Drury University to study the sources of nutrient contamination in a spring system north of Springfield. Several undergraduate students gained valuable research experience on this project. This project will lead to research programs for combined groups of MSU and Drury students in Summer 2008.

Besides the research activities highlighted above, OEWRI produced a number of research-related products in 2007. OEWRI and its collaborative projects generated 9 journal articles, 8 project reports, and 39 conference or meeting presentations. Grant production for 2007 included 10 grants received totaling \$795,000. These accomplishments are listed below.

Journal Articles (9)

- (1) Nickolotsky, A., and R.T. Pavlowsky, 2007. Morphology of step-pools in a wilderness headwater stream: The importance of standardizing geomorphic measurements. *Geomorphology* 83:294-306.
- (2) Lecce, S., R. Pavlowsky, and G. Schlomer, in press (available on-line in August 2007). Mercury contamination of active channel sediment and floodplain deposits from historic gold mining at Gold Hill, North Carolina, USA. *Environmental Geology*
- (3) Wang N, Augspurger T, Barnhart MC, Bidwell JR, Cope WG, Dwyer FJ, Geis S, Greer IE, Ingersoll CG, Kane CM, May TW, Neves RJ, Newton TJ, Roberts AD, Whites DW. 2007. Intra- and interlaboratory variability in acute toxicity tests with glochidia and juveniles of freshwater mussels (Unionidae). *Environmental Toxicology and Chemistry* 26(10):2029-2035.
- (4) Wang N, Ingersoll CG, Hardesty DK, Ivey CD, Kunz JL, May TW, Dwyer FJ, Roberts AD, Augspurger T, Kane CM, Neves RJ, Barnhart MC. 2007. Acute toxicity of copper, ammonia, and chlorine to glochidia and juveniles of freshwater mussels (Unionidae). *Environmental Toxicology and Chemistry* 26(10):2036-2047.
- (5) Wang N, Ingersoll CG, Greer IE, Hardesty DK, Ivey CD, Kunz JL, Brumbaugh WG, Dwyer FJ, Roberts AD, Augspurger T, Kane CM, Neves RJ, Barnhart MC. 2007. Chronic toxicity of copper and ammonia to juvenile freshwater mussels (Unionidae). *Environmental Toxicology and Chemistry* 26(10):2048-2056.
- (6) Bringolf, RB, Cope WG, Eads CB, Lazaro PR, Barnhart MC, Shea D. 2007. Acute and chronic toxicity of technical grade pesticides to glochidia and juveniles of freshwater mussels (Unionidae). *Environmental Toxicology and Chemistry* 26(10):2086-2093.
- (7) Bringolf RB, Cope WG, Mosher S, Barnhart MC, Shea D. 2007. Acute and chronic toxicity of glyphosate compounds to glochidia and juvenile *Lampsilis siliquoidea* (Unionidae). *Environmental Toxicology and Chemistry* 26(10):2094-2100.
- (8) Bringolf RB, Cope WG, Barnhart MC, Mosher S, Lazaro PR, Shea D. 2007. Acute and chronic toxicity of pesticide formulations (atrazine, chlorpyrifos and permethrin) to glochidia and juveniles of *Lampsilis siliquoidea* (Unionidae). *Environmental Toxicology and Chemistry* 26(10):2101-2107.
- (9) Medley, K.A., and J.E. Havel. 2007. Hydrology and local environment influences on zooplankton communities in floodplain ponds. *Wetlands* 27: 864-872.

Project Reports (8)

- (1) Owen, M., and R. Pavlowsky, 2007. Quality assurance project plan for: water quality monitoring and analysis of the Bennett Spring watershed and recharge area (OEWRI QA07-001), February 20, 2007.
- (2) Pavlowsky, R., J. Steiert, D. Gouzie, B. Gerik, and S. Armstrong, 2007. Finley Creek baseline water quality monitoring project final report (OEWRI EDR-07-002), March 16, 2007.
- (3) Miller, R., R. Biagioni, and R. Pavlowsky, 2007. Jordan Creek baseline water quality project (OEWRI TR06-003), March 19, 2007.

- (4) Hoggard, H., and R. Pavlowsky, 2007. Quality assurance project plan for the project, “nonpoint source and water quality trends in the Pearson Creek watershed” (OEWRI QA07-002), February 20, 2007.
- (5) Pavlowsky, R., 2007. Geomorphic analysis of the main channel of the Golf Club of Kansas Site in Lenexa, Kansas. Final report to Olsson Associates, Springfield, Missouri. May 22, 2007.
- (6) MEC Water Resources. Inc, and OEWRI (R. Pavlowsky), 2007. Southwest Missouri water quality improvement project (WQIP): James River basin water quality gap analysis. Final report to the Environmental Resources Coalition, Jefferson City, Missouri, October 2007.
- (7) Owen, M., M. Gossard, and R. Pavlowsky, 2007. Pre-construction report for the Ward Branch stream restoration project (OEWRI EDR-07-004). Phase one final report to Greene County, Missouri, November 14, 2007.
- (8) Chick, J., J. Havel, J. Jack, P. Bukaveckas, and A.K. Aufdenkampe. Analyses of zooplankton, chlorophyll, and geochemistry samples for the EMAP Great River Ecosystems Project. Progress report to US Environmental Protection Agency. 16 pp.

Presentations (39)

- (1) Lecce, S., R. Pavlowsky, and G. Schlomer, 2007. Mercury contamination of floodplain sediments from historic gold mining in Gold Hill, North Carolina. Association of American Geographers Annual Meeting, San Francisco, CA, April 17-21.
- (2) Schlomer, G., R. Pavlowsky, and S. Lecce, 2007. Using geochemical and sedimentological trends to identify pre- and post- settlement boundaries in floodplain deposits of the North Carolina Piedmont. Association of American Geographers Annual Meeting, San Francisco, CA, April 17-21.
- (3) Owen, M, R. Pavlowsky, M. Gossard, and T. Smith, 2007. Channel restoration of urbanizing stream of the Ozarks Plateaus, Greene County, Missouri. Association of American Geographers Annual Meeting, San Francisco, CA, April 17-21.
- (4) Armstrong, S. and R. Pavlowsky, 2007. Human transformation of a karst catchment in Springfield, Missouri. Association of American Geographers Annual Meeting, San Francisco, CA, April 17-21.
- (5) Gossard, M., and R. Pavlowsky, 2007. Sediment budget approach to evaluate urban-related instability in an Ozarks stream. Association of American Geographers Annual Meeting, San Francisco, CA, April 17-21.
- (6) Pavlowsky, R., 2007. Geomorphic resistance and the lack of channel change in a disturbed Ozark river. Association of American Geographers Annual Meeting, San Francisco, CA, April 17-21.
- (7) Mukherjee, A., X. Miao, J. Luo, and R. Pavlowsky, 2007. Sinkhole mapping using LIDAR in Nixa, Missouri. Annual meeting of the Geological Society of America., Denver, CO, October 28-31.
- (8) Bhattacharyya, M., K. Evans, and R. Pavlowsky, 2007. Stream piracy and paleochannels in western Missouri. Annual meeting of the Geological Society of America., Denver, CO, October 28-31.

- (9) Schlomer, G., R. Pavlowsky, and S. Lecce, 2007. Using geochemical and sedimentological trends to characterize pre- and post- settlement overbank floodplain deposits in a North Carolina Piedmont watershed. Annual meeting of the Geological Society of America., Denver, CO, October 28-31.
- (10) Mukherjee, A., X. Miao, J. Luo, and R. Pavlowsky, 2007. GIS Database for sinkhole hazard assessment in Christian County. Missouri. Joint South-Central and North-Central Sections Annual meeting of the Geological Society of America, Lawrence, KS, April 11-13
- (11) Bhattacharyya, M., K. Evans, and R. Pavlowsky, 2007. Abandoned valleys in western Missouri: Implications for landscape evolution of the northwest Ozark Plateau Borderland Joint South-Central and North-Central Sections annual meeting of the Geological Society of America, Lawrence, KS, April 11-13.
- (12) Carroll, T., 2007. The effect of resource pulses and spatial subsidies on food web dynamics and community structure in karst springs of the Ozarks. North American Benthological Society 55th Annual Meeting, June 3-8, 2007 Columbia, South Carolina.
- (13) McMurray, S., C. Barnhart and A. Roberts. 2007. The intertwined interests of fish, mussels, and those who care for them American Fisheries Society, Madison WI 12/10/07
- (14) Barnhart, M.C. 2007. Update on mussel propagation in Missouri. Missouri Department of Conservation Warmwater Hatcheries Meeting, Sweet Springs, MO 12/4/07
- (15) Kunz, James L., Nile N. Kemble, Chris G. Ingersoll, Ning Wang, Andy Roberts, Jim F. Dwyer, Dave Mosby, and M. C. Barnhart. 2007. Evaluation of the toxicity of metal-contaminated sediments in the Spring River drainage basin of Missouri to juvenile mussels (*Lampsilis siliquoidea*) and amphipods (*Hyalella azteca*). Society for Environmental Toxicology and Chemistry, Milwaukee, WI. 11/11/07
- (16) Barnhart, M. C. 2007. Recent discoveries in life-history complexity of freshwater mussels: putting endangered species in perspective. Conservation Management of the Clinch and Cumberland River Systems: A Collaborative Discussion on Coal Mining and the Aquatic Environment. Southwest Virginia Higher Education Center, Abingdon, Virginia. 9/6/07.
- (17) Barnhart M.C. 2007. Methods for caging juvenile mussels in streams and ponds. Kansas Pearly Mussel Workshop, Pittsburg State University, Pittsburg Kansas. 7-19-07.
- (18) Fobian, Todd and M. C. Barnhart. 2007. Reproductive biology of the rabbitsfoot mussel in the Upper Arkansas River system, White River system, and Red River system. Kansas Pearly Mussel Workshop, Pittsburg State University, Pittsburg Kansas. 7-19-07.
- (20) Barnhart M.C. and G.T. Watters. 2007. Life history strategies of unionoid mussels. Fifth Biennial Symposium of the Freshwater Mollusc Conservation Society. Little Rock, AR.
- (21) Cope W.G., A.D. Christian, R.B. Bringolf, N. Wang, T.J. Newton, J.L. Farris, T. Augspurger, F.J. Dwyer, M.C. Barnhart, R.J. Neves, E. Hammer, and C.G. Ingersoll. 2007. Freshwater mussel ecosystem ecology: the integrated functional roles of water quality, pollution, and physical habitat in supporting adult and early life stages of freshwater mussels and their role in nutrient recycling. Fifth Biennial Symposium of the Freshwater Mollusc Conservation Society. Little Rock, AR.

- (22) Bringolf R., S. Mosher, P. Lazaro, C. Eads, M.C. Barnhart, D.Shea, and G.Cope. 2007. A comprehensive assessment of the hazards of current use pesticides to native freshwater mussels. Fifth Biennial Symposium of the Freshwater Mollusc Conservation Society. Little Rock, AR.
- (23) Wang N., C.G. Ingersoll, F.J. Dwyer, A.D. Roberts, T.Augspurger, C.M. Kane, R.J. Neves, and M.C. Barnhart. 2007. Assessing contaminant sensitivity of early life stages of freshwater mussels. Fifth Biennial Symposium of the Freshwater Mollusc Conservation Society. Little Rock, AR.
- (24) Barnhart M.C., T.B. Fobian, D.W Whites, and C.G. Ingersoll. 2007. Mussel silos: Bernoulli flow devices for caging juvenile mussels in rivers. Fifth Biennial Symposium of the Freshwater Mollusc Conservation Society. Little Rock, AR
- (25) Fobian T.B. and M.C. Barnhart. 2007. Reproductive biology of the rabbitsfoot mussel (*Quadrula cylindrica*) in the upper Arkansas River system, White River system and the Red River system. Fifth Biennial Symposium of the Freshwater Mollusc Conservation Society. Little Rock, AR.
- (26) Pandolfo, T.J., W.G. Cope, R.B. Bringolf, D.B. Buchwalter, M.C. Barnhart, and H.L. Dunn. 2007. Sensitivity of glochidia, juvenile, and adult native freshwater mussels to a range of common and extreme water temperatures. Fifth Biennial Symposium of the Freshwater Mollusc Conservation Society. Little Rock, AR.
- (27) Beussink, Zac and M.C. Barnhart. 2007. Effects of host exposure to suspended clay on attachment and transformation success of mussel glochidia. Fifth Biennial Symposium of the Freshwater Mollusc Conservation Society. Little Rock, AR.
- (28) Barnhart, M.C. 2007. Buckets of muckets: methods for laboratory culture of freshwater bivalves. Aquaculture 2007, World Aquaculture Society, San Antonio, TX
- (29) Beussink, Zac and M.C. Barnhart. 2007. Effects of host fish exposure to suspended sediments on the attachment and transformation of mussel larvae. Missouri Natural Resources Conference, Lake Ozark, MO.
- (30) Fobian, Todd and M. C. Barnhart. 2007. Reproductive biology of the rabbitsfoot mussel (*Quadrula cylindrica*) in the upper Arkansas River system, White River system and the Red River system. Missouri Natural Resources Conference, Lake Ozark, MO.
- (31) Dickerson, K.D., and J.E. Havel, 2007. Copepod diversity and abundance in the Missouri River. Graduate Interdisciplinary Forum, Missouri State University.
- (32) Havel, J.E. Diversity and abundance of zooplankton in the Missouri River, 2007. EMAP-GRE workshop, Alton, Illinois.
- (33) Armstrong, Stacey, 2007. Geomorphic history and analysis of a small urbanizing karst watershed in Springfield, Missouri. Graduate Interdisciplinary Forum, Missouri State University.
- (34) Mukherjee, Arindam, 2007. Using GIS to evaluate sinkhole collapse risk in Christian County, Missouri. Graduate Interdisciplinary Forum, Missouri State University.
- (35) Gossard, Mark, 2007. Sediment budget approach to understanding gravel sources and transport in Ward Branch, Springfield, Missouri. Graduate Interdisciplinary Forum, Missouri State University.

- (36) Bhattacharyya, Mayuri, 2007. Stream-piracy in the Ozarks. Graduate Interdisciplinary Forum, Missouri State University.
- (37) Carr, Travis, 2007. Historical channel change in the middle James River Valley. Graduate Interdisciplinary Forum, Missouri State University.
- (38) Gray, Jefferson, 2007. Channel changes on a small urbanizing Ozark stream in Nixa, Missouri. Graduate Interdisciplinary Forum, Missouri State University.
- (39) Muchiri, Gitonga, 2007. Water quality sampling in residential subdivisions in Christian County, Missouri. Graduate Interdisciplinary Forum, Missouri State University.

Grants

OEWRI principal investigators received 9 externally-funded grants totaling \$605,000 in 2007. In addition, OEWRI partnered up with Chemistry and Physics and Material Science to receive an internal University “provost incentive” grant for \$190,000 to support the purchase and start-up of a solid-state Magnetic Nuclear Resonance system in chemistry. The 2007 total includes a \$494,000 grant from the USEPA to use for phase II start-up funding. Four OEWRI grant proposals were denied during the same period. OEWRI was also involved with ongoing work on 9 additional grants funded prior to 2007 totaling over \$900,000.

Funded Proposals

- (1) Pavlowsky, R., 2007. OEWRI start-up funding from USEPA (year two)-August 2007, \$494,000.
- (2) Pavlowsky, R., 2007. Ravenwood stream stability, Springfield, MO. Contract with Olsson Associates, \$1,850.
- (3) Pavlowsky, R., 2007. Lenexa I: Golf Course stream restoration, Lenexa, KS. Contract with Olsson Associates, \$5,000.
- (4) Pavlowsky, R., 2007. Lenexa II: City Center stream assessment, Lenexa, KS. Contract with Olsson Associates, \$6,000
- (5) Pavlowsky, R., and S. Lecce, 2007. Mercury contamination of floodplain sediments from historical gold mining in North Carolina, National Geographic Society-Committee for Research and Exploration grant, \$19,581 (\$11,750 to MSU). Collaboration with S. Lecce at East Carolina University.
- (6) Rhodes, R., 2007. Assessment of phytoplankton abundance in water supplied for mussel production. Virginia Department of Game and Fisheries. \$4,000.
- (7) Barnhart, C., 2007. Restoration of the Federal candidate Neosho mucket (*Lampsilis rafinesquena*) in NE Oklahoma. The Peoria Tribe of Indians of Oklahoma, \$32,590.
- (8) Barnhart, C., 2007. Determine the sensitivity of Ozark mussels to zinc, lead, and cadmium in water and sediment. USGS Biological Resources Division, \$20,000.

(9) Havel, J., 2007. Analysis of Zooplankton from the Ohio River. USEPA via University of Louisville, \$29,250.

(10) Co-PI on Provost Research Incentive Program Grant entitled, "Solid-State Nuclear Magnetic Resonance Research Facility," with lead PI, Gary Meints (CHM). Total budget: \$190,000.

Declined Proposals for 2007

(1) Webb, G., B. Fuqua, and A. Rimal 2007. Vegetation buffer strip effectiveness and technology for grazing systems in the Ozarks. Missouri Life Sciences Trust Fund, \$556,000. (OEWRI led planning meeting, drafted project proposal outline, and is a major collaborator)

(2) Pavlowsky, R., and R. Biagioni, 2007. Water Quality Laboratory Analyses for Ozarks Waterborne Pathogens Project. Missouri Life Sciences Trust Fund, \$42,000 (OEWRI's portion on a collaborative project with University of Missouri-Columbia and Watershed Committee of the Ozarks).

(3) Meints, G., P. Kahol, and R. Pavlowsky, 2007. MRI: Acquisition of solid-state NMR, Instrumentation for Research and Research Training at MSU. National Science Foundation-major research instrumentation program, \$174,000.

(4) Lecce, S., and R. Pavlowsky, 2007. Mercury bioavailability in fluvial sediment deposition in streams affected by historical gold mining in the North Carolina Piedmont. NC Water Resources Grant, \$40,000.

Continuing Grant Support from Previous Years

(1) Pavlowsky, R., 2006. James River Stormwater Runoff 319 Project: water quality monitoring component. James River Basin Partnership and MoDNR, \$69,910.

(2) Pavlowsky, R., 2006. WQIP Gap Analysis for Southwest Missouri. Contract with MEC Water Resources, Columbia, MO, \$108,500.

(3) Davis, A., D. May, and R. Pavlowsky, 2006. Bennett Spring State Park area: Planning for wastewater treatment and water quality education (404b). USEPA, \$62,175 (\$6,470 to OEWRI, the rest goes to CRPM).

(4) Pavlowsky, R., 2006. OEWRI at MSU-Phase 1 Start-up Funding. USEPA, \$496,000.

(5) Pavlowsky, R., J. Steiert, and D. Gouzie, 2006. Finley Creek water quality baseline study. James River Basin Partnership, \$6,757.

(6) Pavlowsky, R., 2006. Nutrient analysis for Beaver Creek water quality monitoring project. USEPA/UWRBF via Bull Shoals Field Station, \$6,757.

(7) Pavlowsky, R. 2005. Ward Branch channel and water quality monitoring 319 Project. USEPA/MoDNR via Greene County, \$64,000.

(8) Evans, K., and J. Miller, 2006. Age and origin of the Weaubleau structure: a possible meteorite impact structure in Missouri. National Science Foundation, \$133,000.

(9) Havel, J., 2005. Planktonic indicators of reference conditions in Great Rivers: analyses for the EPA EMAP program. USEPA via University of Illinois, \$12,334.

EDUCATIONAL SUPPORT AND STUDENT INVOLVEMENT

OEWRI dedicates a significant amount of effort to training and research support for undergraduate and graduate students. Furthermore, assistance is also distributed among the faculty who teach and advise those students. Since staff offices are located on the third floor of Temple Hall in close proximity to CNAS departments, it is only reasonable to expect that OEWRI supports curriculum and teaching activities through technical assistance, research methodologies, and environmental database access. In 2007, OEWRI staff and facilities provided technical and educational resources for undergraduate and graduate students in CNAS departments including GGP, BIO, CHM, and AGR, College of Business Administration, Department of Anthropology, and Drury University.

Thirteen paid undergraduate students worked for OEWRI and its collaborative projects in 2007, all but one anthropology student came from CNAS departments. In addition, 11 undergraduate research projects were also supported. A list of these students and their programs are found below.

OEWRI projects provided graduate assistantships for 19 students in three programs (Biology, Geospatial Science, and Business Administration) in 2007. In addition, the Institute helped support 12 MS thesis projects through technical advice, training, data acquisition, supplies, and instrument use. One national conference award was received by an MSU student supported by OEWRI. A list of these students and their programs are found below.

Undergraduate Hourly Workers (13 students)

- (1) Elizabeth Alby, sophomore, Chemistry (Fall 2007), nutrient analyses
- (2) Sarah Bunton, senior, Agriculture (Spring 2007), soil laboratory
- (3) Gillian Gones, senior, Planning (Spring 2007), field assistant
- (4) Sarah Handlang, senior, Chemistry (Fall 2007), nutrient and TIC/TOC analyses
- (5) Tessa Huckaba, Geology (all 2007), soil laboratory
- (6) Kristin Legg, senior, Biology (all 2007), nutrient and metal analyses
- (7) Keven McKee, junior, Chemistry (all 2007), CNS analyses, particle size analysis
- (8) Robert Powers, junior, Chemistry (Spring 2007), nutrient analysis
- (9) Mary Ann Siple, junior, Anthropology (all 2007), soil laboratory
- (10) Amanda Williams, senior, Geography (all 2007), field assistant and soil laboratory
- (11) David Packwood, Biology (all 2007), field assistant and aquatic laboratory

(12) Rebecca Brondel, Biology, (Spring & Summer 2007), field assistant and aquatic laboratory

(13) Erin Hutchison, Biology, (Spring & Fall 2007), website and aquatic laboratory

Undergraduate Student Research Projects (11 students)

Missouri State University

(1) Marissa Berger, Geology (Fall 2007), Ozarks Glade soils

(2) Phillip McCutcheon, Geography (Fall 2007), Finley River discharge

(8) Erin Hutchison, Biology (Fall 2007), Web site for displaying zooplankton diversity

(3) Jennifer Rideout, Anthropology- (Fall 2007), James River floodplain and terrace soils

(4) Derrick Sinclair, Geography (Fall 2007), Soil fertility on CRP land

(5) Mary Ann Siple, Anthropology (Fall 2007), Ward Branch floodplain deposition

(6) Amanda Williams, Geography(Fall 2007), Geomorphic changes of Ravenwood tributary

(7) Brian Yerkas, Geography (Fall 2007), Arkansas River sand bars

Drury University (with Teresa Carroll)

(1) Chad Cooper (Spring and Summer 2007)

(2) Bonnie Welch (Spring 2007)

(3) Cody Moriiuchi (Spring 2007)

(4) Adam Boulyard (Fall 2007)

Graduate Assistantships (19 students)

(1) Stacey Armstrong, Geospatial Science (Spring 2007-hourly worker)

(2) Mayuri Bhattacharyya, Geospatial Science (Spring 2007)

(3) Mark Gossard, Geospatial Science (Spring & Summer 2007)

(4) Gitonga Mucheri, Geospatial Science (all 2007)

(5) Arindam Mukherjee, Geospatial science (Spring 2007)

- (6) Anthony Saitta, Biology (Fall 2007)
- (7) Gwenda Schlomer, Geospatial Science (all 2007)
- (8) David Speer, Geospatial Science (Fall 2007)
- (9) Shekinah Sunder-Raj, Business (Fall 2007)
- (10) Brian Swift, Geospatial Science (Fall 2007)
- (11) Patrick Womble, Geospatial Science (Fall 2007)
- (12) Todd Fobian, Biology (Spring 2007)
- (13) Zac Beussink, Biology (Summer 2007)
- (14) Jen Duzan, Biology, (all 2007)
- (15) Mike Pillow, Biology (Fall 2007)
- (16) Rebecca Brondel, Biology (Fall 2007)
- (17) Kelli Dickerson, Biology (Spring & Fall 2007)
- (18) Angela Bandy, Biology (partial, Spring 2007)
- (19) Jason Wolf, Biology (Spring & Fall 2007)

Completed MS Theses (3)

- (1) Gopala Borchelt, MS Geospatial Science, December 2007. Nutrient Concentrations at Baseflow Conditions in the Upper White River Basin, Southwest Missouri and Northwest Arkansas.
- (2) Zachary Beussink, MS Biology, 2007. Effects of sediment exposure on host suitability for the parasitic glochidia larvae of Unionid mussels.
- (3) Todd Fobian, MS Biology, 2007. Host utilization and reproductive timing among populations of *Quadrula cylindrica*.

National Student Awards (1)

- (1) Gwenda Schlomer, 2007. "Best Masters student research proposal" award. By the: Geomorphology Specialty Group of the Association of American Geographers. Annual Meeting, San Francisco, CA, April 17-21.

Graduate Student Research/Thesis Projects (11)

- (1) David Woods, Biology (Mathis), Effects of chronic copper exposure on the alarm behavior and foraging activity of rainbow darters.
- (2) Bethany Dalrymple, Biology (Waite), Effects of water depth and turbidity on the germination success of Southern wild rice.
- (3) Travis Carr, Geospatial Science (Pavlowsky), Historical sedimentation and channel changes along the James River in the vicinity of Wilson Creek and Delaware Town.
- (4) Brandi Gerik, Biology (Steiert), Bacteria and nutrients in the Finley Creek.
- (5) Mark Gossard, Geospatial Science (Pavlowsky), Channel stability and bed load mobility in Wards Branch.
- (6) Patrick Womble, Geospatial Science (Pavlowsky), Alluvial sedimentation and mining contamination in Lower Pearson Creek.
- (7) David Speer, Geospatial Science (Pavlowsky), Large woody debris distribution and transport in Wilson Creek.
- (8) Gwenda Schlomer, Geospatial Science (Pavlowsky), Use of mining contaminants to evaluate historical overbank sedimentation rates in the Little Buffalo/Dutch Buffalo watershed near Gold Hill, North Carolina.
- (9) Stacey Armstrong, Geospatial Science (Pavlowsky), Geomorphic history and analysis of a small urbanizing karst watershed in Springfield, Missouri.
- (10) Arindam Mukherjee, Geospatial Science (Miao), GIS Database for sinkhole hazard assessment in Christian County, Missouri.
- (11) Gitonga Mucheri, Geospatial Science (Miao), Remote sensing of impervious area in Nixa, Christian County, Missouri.
- (12) Lucas Rengstorf, Geospatial Science (Miao), Remote sensing of riparian buffer land cover in the Finley Creek Watershed, Christian County, Missouri.

SERVICE AND OUTREACH

Service and community outreach is an important component of OEWRI's mission. Activity records typically indicate that OEWRI staff allocate about 5 to 10 percent of their time working on service to the campus community and outreach to the Springfield area. Examples of typical service and outreach activities by OEWRI are described below:

College Service

Finley Creek Bacteria Project: OEWRI has provided supplies and analyses to Dr. John Steiert and his graduate students to complete a study of bacteria levels and sources in the Finley Creek watershed. In addition, a long-

term loan of a multi-probe water quality monitoring sonde was also given to the group in Biology to support water chemistry data collection for the project.

Support of Earth Science Education: OEWRI loaned Dr. Kevin Evans the use of flow meters for use by education students to monitor the flow of streams in the Springfield area. In addition, OEWRI staff also aided Dr. Jill Black in classroom set-up and laboratory preparation for several earth science class activities.

Poster Creation for GGP Department: OEWRI created several promotional display posters outlining the Geospatial Science master program and GGP's undergraduate programs. Posters were professionally printed and mounted for use at meetings in which the department has exhibit space.

Field trip Support: OEWRI helps to provide staff, supplies and equipment, and training on several undergraduate and graduate student field trips per year. For 2007 these classes are as follows:

- (1) South Dry Sac floodplain coring- GEO 651-Advanced Physical Geography (Pavlowsky)
- (2) Channel assessment training day at Ward Branch- GEO 670- Advanced Field Methods (Pavlowsky)
- (3) Channel assessments at South Dry Sac, Wilson, and South Creeks- GEO 670-Advanced Field Methods (Pavlowsky)
- (4) Geomorphic data collection and interpretation at Ward branch- GRY 348 (Pavlowsky)
- (5) Channel geomorphology of Fassnight Creek for BIO 509-Stream Ecology (Havel)
- (6) Use of OEWRI's Giddings soil coring machine and truck for AGA 345-Soil Judging (DeWitt)

University Center Cooperation

Center for Resource Planning and Management: OEWRI is a collaborator with CRPM on an externally-funded project to develop the infrastructure for watershed management for the Bennett's Spring recharge area that supports the sustained economic growth of the area while protecting the water quality of the Upper Niangua River. OEWRI is providing the monitoring and analytical services required to develop a baseline assessment of water quality in the area focusing on nutrients and bacteria.

Center for Archeological Research: OEWRI is cooperating with CAR to support and carry out soil research projects by graduate students to help us to better understand the locations and nature of historical Delaware Town Indian settlements along the James River. In addition, OEWRI and CAR have collaborated on several unfunded proposals and one funded study to investigate the archaeology and soils of the Jordan Valley area for the City of Springfield.

Darr Agricultural Center, Baker's Acres, and Mountain Grove Experiment Station: OEWRI is working with the Agricultural units of MSU to form a new hub at Mountain Grove for research and development of vegetative buffer systems to prevent the release of runoff pollution to streams from grazing livestock and pastures. OEWRI has co-led two efforts to submit proposals to fund this project through the Life Science Trust Fund program (unsuccessful) and a white paper for a federal appropriation (pending). In addition, OEWRI is working with the Darr Agricultural Center to develop an experimental field system to test the mobility and pollution potential of waste water treatment plant biosolids applications on pasturelands headed by the City of Springfield.

Bull Shoals Field Station: OEWRI worked with BSFS in several ways in 2007. First, OEWRI provided water quality laboratory services to BSFS to support a monitoring project on Beaver Creek funded by the Upper White River Basin Foundation. Second, OEWRI supplied GIS and mapping expertise/supplies to develop property maps to support the submission of proposal to fund facilities development at BSFS. Third, OEWRI

worked with BSFS to develop a water quality monitoring program for the Upper White River Basin in Missouri and Arkansas headed by the Upper White River Basin Foundation.

Geospatial Technology Support

USGS benchmark monument: OEWRI staff assisted Dr. Gary Krizanich (USGS) and Dr. Kevin Evans (MSU) in the replacement of the USGS benchmark in front of Carrington Hall along National Street.

GPS base station data access: OEWRI provides server space and public access through our website for Global Positioning Systems (GPS) differential correction data generated from the GGP base station receiver on top of Sunvilla Towers.

Geospaital database access: OEWRI provides access to geospatial data stored on OEWRI servers to GGP graduate students and faculty to support class projects and research

Presentation at Southwest Region GIS User Group Meeting: Gave 20 minute presentation outlining the various projects in which OEWRI uses GIS and other Geospatial technologies as a tool to support their mission.

Map design and production for Ozarks Magazine: OEWRI produced a map of the Ozarks region for the February/March 2008 Issue for the article: “A Map of the Ozarks – So why is it so hard to put your hands on a good map of the Ozarks?” yy: Susan Kirkpatrick, Editor.

Student and Faculty Help: OEWRI provides “walk-in” assistance to students and faculty on a daily basis to help with GIS/GPS/Remote Sensing related tasks and environmental research needs.

Environmental Group Assistance and Outreach

Watershed Committee of the Ozarks, Loring Bullard: OEWRI staff regularly attend monthly Watershed Committee meetings to participate and give updates on OEWRI projects and website postings. OEWRI is working with the Watershed Committee on ad hoc committees on regional monitoring needs, water supply problems, and the new Watershed Center at Valley Water Mill.

James River Basin Partnership, Holly Neill: OEWRI made a presentation to the James River Basin Partnership Board Meeting on April 27, 2007 about the water quality problems in the Finley River. In addition, OEWRI is working with the JRBP to develop a watershed management plan for the James River Basin and complete a study on the effect of storm water from residential subdivision on water quality.

Upper White River Basin Foundation, John Moore: OEWRI worked with UWRBF to create and be part of the DVD video, “White River Heritage: Guarding the Treasure.” Additionally, as an externally-funded project, OEWRI provided water quality monitoring services to the Foundation in support of their USEPA Targeted Watershed grant. Presently, OEWRI is involved with UWRBF to develop a long-term water quality program for the Upper White River Basin involving collaboration with USGS, BSFS, University of Arkansas, and Drury University.

Table Rock Lake Water Quality, Inc., David Casaletto: OEWRI helped with technical assistance to for a watershed management grant to the TRLWQI. OEWRI also provides the group with expertise and information in support of their pollution control and monitoring programs.

Environmental Resource Coalition, Betty Wyse: OEWRI working with ERC on the WQIP GAP project for southwest Missouri to identify the water quality monitoring needs of the region for the future. This is a large effort also involving MEC-Water Resources, Inc., University of Missouri-Columbia, and several watershed groups. We have also collaborated with Betty Wyse to organize, post, and maintain an environmental publications database for the region.

Southwest Missouri Resource Conservation and Development Council, Rita Mueller: OEWRI provided SWRC&D with technical assistance and expertise to help them design and plan a water quality monitoring program to support their Nonpoint Sources 319 grant from the Missouri Department of Natural Resources.

Elk River Watershed Improvement Association, Drew Holt: OEWRI is working on a collaborative project to publish a GAP report on the Elk River watershed that identifies the water quality data needs for the watershed in order to aid managers and the public for watershed planning and restoration purposes.

Regional Outreach

Membership in the Tri-Lakes GIS users group: This group works to identify resource needs and opportunities in geospatial data use and sharing in the region for the public use, environmental management, and research. OEWRI staff gave a presentation on how the Institute uses GIS to support its environmental mission at MSU in October 2007 at Ozarks Technical College-Ozark Campus.

Missouri Natural Resources Conference 2007: OEWRI staffed a booth at the annual Missouri Natural Resources Conference at Lake of the Ozarks in January 2007. This conference provides networking, vendor marketing, and technical presentations to support resource management and research statewide.

Tour of facilities for staff leadership conference: Provided a tour of OEWRI laboratory facilities for the Missouri State USA-staff leadership program, December 6, 2007.

Emergency sinkhole collapse response team: Presentation to the City Utilities of Springfield about the origin and causes of the Hawkins sinkhole collapse and its impacts on water quality in Sequiota Spring during February 2007.

James River Watershed MS4/TMDL water quality monitoring: OEWRI is working with Greene County and MDNR to plan, coordinate, and implement a long-term storm water monitoring program for urban areas in the James River Basin to comply with federal clean water act regulations. This effort involves OEWRI as the central hub in working with the communities of Greene County, Christian County, City of Springfield, Ozark, Nixa, and Battlefield to provide both a scientific and economical water quality monitoring program that will help protect the water supplies in the region.

PARTNERSHIPS

One of the major goals for OEWRI is to develop and sustain partnerships across a wide range of environmental interests in the Ozarks and beyond through communication, resource sharing, and projects. In 2007, OEWRI partnered or collaborated with 7 environmental groups, 10 federal and state government agencies, 4 universities, 7 local governments, and 3 private companies. In terms of on-campus collaboration, OEWRI has worked with 4 university centers, 26 faculty from seven departments and with four MSU centers including the Center for Resource Planning and Management, Darr Agricultural Center, Center for Archeological Research, and Bull Shoals Field Station.

OEWRI's 2007 partners are listed by partner type below. Each listing is annotated with the letter code (s) representing the nature of the partnership as follows:

- A: submission of grant proposal, unfunded or pending
- B: collaboration on a funded project
- C: funding source for OEWRI
- D: shared membership on ad hoc environmental issue committee
- E: technical support or expertise supplied by OEWRI
- F: OEWRI attends monthly meetings and/or gave a presentation
- G: shared education and outreach activities
- H: OEWRI advisory board member

Regional Environmental Groups (7)

- Watershed Committee of the Ozarks, Loring Bullard (A, D, E, F, G)
- James River Basin Partnership, Holly Neill (B, C, D, E, F, G)
- Upper White River Basin Foundation, John Moore (B, C, D, E, G)
- Table Rock Lake Water Quality, Inc., David Casaletto (D, E)
- Environmental Resource Coalition, Betty Wyse (B, C, F)
- Southwest Missouri Resource Conservation and Development Council, Rita Mueller (E)
- Elk River Watershed Improvement Association, Drew Holt (D, E, G)

Government Agencies (9)

- Environmental Protection Agency, Region 7 (C, D, E)
- Missouri Department of Natural Resources (C)
- Missouri Department of Conservation (E)
- National Park Service, Heartland Network (C)
- National Resources Conservation Service (D, E, G)
- Southern Missouri Water Quality Project (G)
- Christian County Soil and Water District (E, F)
- USGS-Mid Continent Geographic Science Center (C, E, G)
- U.S. Fish and Wildlife Service (C)

Universities (4)

- University of Missouri-Columbia (A)
- University of Arkansas (D, E, G)
- East Carolina University (A, B, G)
- Drury University (B, G)

Local Governments (7)

- Greene County (B, D, E, G)
- Christian County (D, E)
- City of Springfield (C, D, E)

City of Nixa (D, E)
City of Ozark (D, E)
City of Battlefield (D, E)
City Utilities of Springfield (E, F)

Private Companies (3)

MEC Water Resources (B, C, F)
Olsson Associates (A, B, C, E)
Missouri Partners Inc. (E)

Missouri State University Centers (4)

Center for Archaeological Research (A, B, E)
Center for Resources Planning and Management (B)
Bull Shoals Field Station (A, D, E, G)
Darr Agricultural Center (A, D, E)

Faculty at MSU (26)

Anson Elliot, Head Agriculture (A, E)
Tom Dewitt, Agriculture/NRCS (D, E, G)
Ben Fuqua, Agriculture (A, E, H)
Gary Webb, Agriculture (A, E, H)
Chris Barnhart, Biology (C)
Dan Beckman, Biology (A)
Paul Durham, Biology (C)
Janice Greene, Biology (C, E, H)
John Havel, Biology (B)
Russ Rhodes, Biology (B)
Jack Steiert, Biology (C)
Rich Biagioni, Chemistry (B, E, G)
Gary Meints, Chemistry (A, B, E, G)
Lloyd Smith, Head Computer Science (H)
Tom Plymate, Head Geography, Geology, and Planning (H)
Jill Black, Geography (A)
Jun Luo, Geography (G)
Xin Miao, Geography (G)
Kevin Evans, Geology (E, G)
Melida Gutierrez, Geology (A)
Doug Gouzie, Geology (B, D, G)
Diane May, Planning (B)
George Mathew, Mathematics (H)
Lifeng Dong, Physics and Material Science (H)
Tammy Jahnke, Dean CNAS (H)
Inno Onwueme, Associate Dean CNAS (H)