

**Ozarks Environmental and Water Resources Institute  
Missouri State University**

***ANNUAL REPORT OF ACTIVITIES FOR  
CALENDAR YEAR 2012***

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**July 15, 2013**



## **Ozarks Environmental and Water Resources Institute**

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#### **EXECUTIVE SUMMARY**

OEWRI activities in 2012 focused primarily on attracting external funds, developing and sustaining partnerships, student mentoring and training, and implementing applied and basic research projects to support science-based monitoring and analysis of water and sediment quality trends and watershed function and disturbance in Missouri. In addition, OEWRI has supported several thesis projects and additional outreach in the areas environmental management and geotourism in Jamaica.

Research accomplishments include work on 11 externally funded projects totaling about \$204,000 in funds expended by OEWRI in 2012. No peer-reviewed articles were published, two final project reports submitted to sponsors, and 31 conference and invited presentations were delivered.

Activity records typically indicate that OEWRI staff spend about 5 to 15 percent of their time per week working on education, service, and outreach activities for the campus community and Springfield area.

Undergraduate education accomplishments include the hiring of 6 hourly workers, research project support and mentoring for 5 students, and field trip experiences for about 50 students.

Graduate education accomplishments include the hiring of 13 graduate assistants and varying levels of support for 21 thesis projects with 4 MS graduates.

OEWRI provides extensive service and outreach to the community and is involved in many planning committees, environmental events, and conferences. The number of partners involved

with the Institute is extensive at all levels. In 2012 OEWRI worked with 8 MSU faculty, 3 MSU centers, and 29 other units including 7 watershed groups.

Two factors slowed OEWRI productivity in 2012 to some degree: (i) our long-time laboratory manager left for another position in September and it took until February to hire a replacement; and (ii) construction of the vivarium interfered with laboratory operations.

OEWRI contributes to the Public Affairs mission of MSU through research, outreach, and student trips in Jamaica to address community problems, by involving students in high profile environmental projects that challenge them to examine leadership and ethical dimensions, and maintaining strong connections with community leaders and stakeholders in the area of environmental issues and water resources management.

## INTRODUCTION

Missouri State University's Board of Governors established the Ozarks Environmental and Water Resources Institute (OEWRI) in January 2004 to address water resource problems within the Ozarks through research, education, and outreach. Funding to start the institute included a one million dollar grant through the U.S. Environmental Protection Agency-Region 7 beginning 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 of both environmental managers and Ozark communities: water quality and quantity, sedimentation and soil/sediment quality, and geospatial analysis of land use and natural resources. Dr. Pavlowsky was selected through a university search to be the director of OEWRI in March 2005. OEWRI is administered within the College of Natural and Applied Science through the Department of Geography, Geology, and Planning (GGP). Additional information about OEWRI can be found at: <http://www.oewri.missouristate.edu/>.

This is the annual report of 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 and facilities;
- (2) Description of activities for 2012
- (3) Accomplishments in research, education, outreach, partnerships, and Public Affairs
- (4) Budget Expenditures and Income for 2012

(5) Strategic Plan for 2013

(6) Resource Needs

## **MISSION STATEMENT AND FACILITIES**

The mission statement for OEWRI was initially approved by the MSU Board of Governors in 2004. It was later revised and expanded to include program areas of emphasis by a committee of 14 CNAS faculty in 2007.

***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 and beyond. 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.

OEWRI supports Missouri State University's mission in [public affairs](#) and its three components in ethical leadership, cultural competence, and community engagement. In addition, OEWRI programs are central to the public affairs theme in science and the environment for research and education. It directs and collaborates on basic and applied research projects aimed at solving environmental problems by working in partnership with university researchers, environmental groups, local communities, and government agencies. It involves students in all levels of its activities.

### **Staffing**

OEWRI is staffed on campus in Temple Hall as follows:

- (1) Robert Pavlowsky, PhD., Director, half-time;
- (2) Marc Owen (M.S. Resource Planning), Assistant Director and project manager, Soil Quality, Geomorphology, and Field Monitoring;
- (3) Tyler Smith (M.S. Biology), Research specialist I, Manager of the Water and Soil Quality Laboratory; and
- (4) 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 GGP control. OEWRI space is allocated in partnership with other units as follows:

#### Department of Geography, Geology, and Planning

Director's office- T321;  
Staff & GA offices- T326, T343, and T307;  
Geomorphology Laboratory & GA office- T125 (supervised by Pavlowsky); and  
Sample Preparation Laboratory, T129 (shared use area).  
Field Equipment Storage and GA office, T103

#### Department of Chemistry

Lachat Nutrient laboratory, T470 (supervised by Dr. R. Biagioni); and  
Metals/ICP-AES laboratory, T437 (supervised by Dr. R. Biagioni).

#### Department of Biology

Microbiology laboratory- T239 (supervised by Dr. John Steiert).

#### Outdoor Storage

Three trucks in SW parking deck, including one truck-mounted Giddings soil coring rig.  
John boat/motor and canoes in back lot of Kemper Hall.  
Box trailer in Cherry Street fenced area

### **Program Areas**

OEWRI activities at the Institute primarily focus on the following six program areas:

### (1) Water and Sediment Quality Laboratory

Laboratory instrumentation and facilities to study 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); metals (Cu, Pb, Zn, etc.); 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 OEWRI laboratory offers the following soil/sediment analyses: particle size distribution by laser diffraction, hydrometer, and dry/wet sieving; sediment particle density; two sonic sifters; soil pH; total and inorganic carbon; available, extractable, and total trace metals, major elements, mercury, and phosphorus; gamma spectrophotometer to measure radioisotope activity (Cs-137, Pb-210); MS2 magnetic susceptibility system; and other standard soils tests.

### (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 and predict future changes. 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 contamination* in 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 governments, consultants, agencies, environmental groups, and other universities to address water resources problem associated with urban and agricultural land management, biomonitoring, and water supply. 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 Watershed Committee of the Ozarks, James River Basin Partnership, City of Springfield, and Greene County, Missouri. Agricultural conservation initiatives include a pilot study on the mobility of potential contaminants after field treatments with biosolids. 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.

OEWRI is involved with regional 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 the past, OEWRI has been 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 at MSU. In 2011 OEWRI supported 6 undergraduate hourly workers and 8 undergraduate research projects. Further, the Institute supported 10 graduate assistants and 20 master thesis projects. In addition, OEWRI staff provided an important “on call” 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 OEWRl projects. Several OEWRl graduate assistants have gone on to jobs in the environmental management field in the Ozarks after graduation.

### **OEWRl “Start-Up” Projects**

From 2006 to 2010, the primary objective of OEWRl was to implement a start-up plan supported by two federal grants from the USEPA.-Region 7 totaling \$984,000. In October 2010, U.S.E.P.A.-Region 7 notified MSU that OEWRl had fulfilled its contract obligations for the start-up grant in full and closed the project.

The Start-up Plan had the following objectives:

- (i) Provide infrastructure and develop office and laboratory space;
- (ii) 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;
- (iii) Develop EPA-approved Quality Assurance Program Plans (QAPPs) and Standard Operating Procedures (SOPs) for all laboratory/analytical, field monitoring, and geospatial techniques;
- (iv) 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;
- (v) Develop and support environmental and water resource website services including data delivery and communication systems;
- (vi) 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;
- (vii) Host and sponsor water research and resources conferences for the Ozarks; and
- (viii) Plan and implement four water and sediment quality research projects that address regional water quality concerns as determined by government agencies, watershed stakeholders, and published TMDLs. These four projects were: (i) Water quality assessment of the Pearson Creek Watershed; (ii) Measurement of suspended sediment, inorganic and organic carbon, nutrient, and dissolved chemical loads in the James River Basin; (iii) Historical and present-day channel stability and gravel bar occurrence within Finley Creek; and (iv) History of mining sediment contamination and channel/floodplain sedimentation in the Middle James River Valley.

## INSTITUTE ACTIVITIES FOR 2012

OEWRI activities in 2012 focused on attracting external funds, formation of partnerships, student mentoring and training, and implementing applied and basic research projects to support science-based monitoring and analysis of water and sediment quality trends, watershed function and disturbance, and land use/land cover change in southwestern Missouri. In addition, OEWRI has been working in partnership with the Bluefields Bay Friendly Fisherman's Society to assess the marine fishery, habitat characteristics, and environmental threats in the Bluefields Bay Fish Sanctuary in Jamaica.

## RESEARCH ACCOMPLISHMENTS

OEWRI's research accomplishments include work on externally funded projects, publications, and presentations. Specific accomplishments for 2012 are listed below

### External Grants

OEWRI worked on 11 externally funded projects in 2012. Six were continuing from previous years and five were new in 2012. The total multi-year value of the active grants in 2012 was approximately \$778,000. The total budget for the five new grants in 2012 was \$196,000. The value of external funds spent by OEWRI in the 2012 single year period totaled \$183,000. This amount included an indirect cost contribution from OEWRI to the university and college of about \$20,000.

OEWRI submitted two proposals in 2012 that were not funded. One proposal was to the National Science Foundation's low temperature geochemistry program with Missouri S & T Geology faculty entitled "Geochemical phases, mobility, and isotopic signature of lead in road dust from Missouri's lead producing regions." OEWRI's funding level was \$64,000 over two years. The other proposal was to the Missouri NSF-EPSCOR program for a proposal entitled "Aquatic Assessment and Restoration Center (AARC) at Missouri State University" with Drs. Barnhart (BIO) and Miao (GP) co-PIs. The 11 active grants for 2012 are briefly described below:

(1) James River Urban Stream MS-4 & TMDL Monitoring Program

Sponsor: Greene County and local governments

Budget No. M02025-1520123-021    Total: \$200,000    2012: \$40,000

Period: 08-01-08 to 07-31-13    IC rate: 38.5% DC

(2) Big River Mining Sediment Storage Assessment

Sponsor: U.S. Fish and Wildlife Service, Columbia, MO

- |                              |                     |                |
|------------------------------|---------------------|----------------|
| Budget No. I02172-152013-021 | Total: \$151,279    | 2012: \$15,000 |
| Period: 01-09-09 to 09-30-13 | IC rate: \$17.5% DC |                |
- (3) Springfield Urban Stream MS4 Monitoring (annual continuation)
- |                              |                   |                |
|------------------------------|-------------------|----------------|
| Sponsor: City of Springfield |                   |                |
| Budget No. M02029-152013-021 | Total: \$28,000   | 2012: \$28,000 |
| Period: 08-31-10 to 08-31-11 | IC rate: 38.5% DC |                |
- (4) Baseline Study of PAH Sources in Springfield
- |                              |                   |               |
|------------------------------|-------------------|---------------|
| Sponsor: City of Springfield |                   |               |
| Budget No. M02038-152013-021 | Total: \$32,846   | 2012: \$8,000 |
| Period: 11-01-10 to 1-31-12  | IC rate: 38.5% DC |               |
- (5) Urban Watershed Stewardship 319 Project
- |  |                  |                |
|--|------------------|----------------|
| Sponsor: Watershed Committee of the Ozarks (through MoDNR and USEPA) |                  |                |
| Budget No. O02244-152013-021   | Total: \$150,240 | 2012: \$35,000 |
| Period: 04-30-11 to 03-01-15   | IC rate: 13% DC  |                |
- (6) James River Urban Stream MS-4 & TMDL Monitoring Program (cost increase add-on)
- |  |                   |                |
|--|-------------------|----------------|
| Sponsor: Greene County and local governments |                   |                |
| Budget No. M02025-1520123-021                | Total: \$20,000   | 2012: \$20,000 |
| Period: 08-01-11 to 07-31-13                 | IC rate: 38.5% DC |                |
- (7) Asher Creek 319 Project
- |   |                 |              |
|---|-----------------|--------------|
| Sponsor: Greene County Soil and Water District, Springfield, MO |                 |              |
| Budget No. I02364-152013-021                                    | Total: \$37,740 | 2012: 10,000 |
| Period: <b>05-01-12</b> to 01-31-14                             | IC rate: 13% DC |              |
- (8) James River-Stone Co 319 Project
- |   |                 |             |
|---|-----------------|-------------|
| Sponsor: James River Basin Partnership, Springfield, MO |                 |             |
| Budget No. I02358-152013-021                            | Total: \$8,399  | 2012: 5,000 |
| Period: <b>05-21-12</b> to 07-31-13                     | IC rate: 13% DC |             |
- (9) Pearson Creek 319 Project
- |   |                 |              |
|---|-----------------|--------------|
| Sponsor: James River Basin Partnership, Springfield, MO |                 |              |
| Budget No. I02356-152013-021                            | Total: \$60,060 | 2012: 10,000 |
| Period: <b>06-05-12</b> to 02-28-14                     | IC rate: 13% DC |              |
- (10) Viburnum Trend Stream
- |   |                   |              |
|---|-------------------|--------------|
| Sponsor: U.S. Fish and Wildlife Service, Columbia, MO |                   |              |
| Budget No. I02377-152013-021                          | Total: \$88,113   | 2012: 10,000 |
| Period: <b>09-04-12</b> to 12-31-14                   | IC rate: 17.5% DC |              |

(11) Wilson Creek Easement 319 Project

Sponsor: James River Basin Partnership, Springfield, MO

Budget No. - Contract invoice      Total: \$1,800      2012: 1,800

Period: **09-15-12** to 12-15-12      IC rate: 13% DC

**Journal Articles (0 in 2012)**

**Project Final Reports (2)**

Owen, M.R., R.T. Pavlowsky, and D.J. Martin, 2012. *Big River Mining Sediment Assessment Project Big River Borrow Pit Monitoring Project*. Ozarks Environmental and Water Resources Institute, Missouri State University, Springfield, MO, Report no. OEWRI EDR-10-003. Final Report to U.S. Fish and Wildlife Service, Columbia, Missouri.

Pavlowsky, R.T. 2012. *Baseline study of PAH sources and concentrations in pond and stream sediments, Springfield, Missouri*. Ozarks Environmental and Water Resources Institute, Missouri State University, Springfield, MO, Report no. OEWRI EDR-12-002. Final report to the City of Springfield.

**Presentations (31)**

National and International Meetings (7)

Pavlowsky, R.T., Workshop presenter, Geography and Geoscience: Connection Points for Complementary Disciplines, Association of American Geographers annual meeting, New York, February 24-28.

Pavlowsky, R.T., M.R. Owen, S.A. Lecce, L.M., Olson, Historical disturbance and recovery in an Ozarks River, southeast Missouri. Association of American Geographers annual meeting, New York, February 24-28.

Lecce, S.A., and R.T. Pavlowsky, Floodplain storage of sediment contaminated by mercury and copper from historic gold mining at Gold Hill, North Carolina. Association of American Geographers annual meeting, New York, February 24-28.

DeWitt, A., and R.T. Pavlowsky, Channel morphology regime equations for the James River, southwest Missouri Ozarks. Association of American Geographers annual meeting, New York, February 24-28. (Best MS oral paper, Geomorphology Specialty Group)

Kosovich, K., and R.T. Pavlowsky, Gravel sediment sources and bar distribution within the channel network of upper Bull Creek, southwest Missouri, Association of American Geographers annual meeting, New York, February 24-28.

Martin, D.J., and R.T. Pavlowsky, Spatial patterns of channel instability along an Ozark river, southwest Missouri, Association of American Geographers annual meeting, New York, February 24-28.

Pavlowsky, R.T., and S.A. Lecce, 2012. Legacy Hg-Cu contamination of active stream sediments and floodplain deposits in the Gold Hill Mining District, North Carolina. Geological Society of American Annual Meeting, Charlotte, NC, November 4-7.

#### Regional or State Meetings (24)

Daugherty, N., and R.T. Pavlowsky, Nonpoint pollution sources and transport in rural Spring Creek, sw Missouri, Missouri Natural Resources Conference, February 1-3, 2012, Tan-Tar-A Resort, Osage Beach, Missouri.

DeWitt, A.R., and R.T. Pavlowsky, Channel morphology and substrate variability in the James River, Southwest Missouri, Missouri Natural Resources Conference, February 1-3, 2012, Tan-Tar-A Resort, Osage Beach, Missouri. (Best Student Poster by the American Fisheries Society)

Harrington, M.C., and R.T. Pavlowsky, Spatial and temporal variability of annual stream flow records in two Missouri ecoregions, Missouri Natural Resources Conference, February 1-3, 2012, Tan-Tar-A Resort, Osage Beach, Missouri.

Kosovich, K.K., and R.T. Pavlowsky, Gravel sediment sources and bar distribution within the main stem of Upper Bull Creek, southwest Missouri, Missouri Natural Resources Conference, February 1-3, 2012, Tan-Tar-A Resort, Osage Beach, Missouri.

Larkin, A., and R.T. Pavlowsky, Shoreline erosion assessment for Lake of the Ozarks State Park, Missouri, Missouri Natural Resources Conference, February 1-3, 2012, Tan-Tar-A Resort, Osage Beach, Missouri.

Olson, L.M., and R.T. Pavlowsky, Effects of historical mine tailings inputs on channel morphology and substrate, Big River, southeast Missouri. Missouri Natural Resources Conference, February 1-3, 2012, Tan-Tar-A Resort, Osage Beach, Missouri.

Daugherty, N., and R.T. Pavlowsky, 2012. Nonpoint pollution sources and transport in rural Spring Creek, SW Missouri. Ozark Summit 2012, Missouri State University, June 12-14.

DeWitt, A.R., and R.T. Pavlowsky, Regime models as tools for stream restoration in the James River, southwest Missouri Ozarks, Ozark Summit 2012, Missouri State University, June 12-14.

Harrington, M.C., In-channel flow trends in Missouri using historical records and contemporary stream flow models, Ozark Summit 2012, Missouri State University, June 12-14.

Hoggard, H., and R.T. Pavlowsky, Urban water quality in the Springfield, Missouri area: MS4 monitoring results, Ozark Summit 2012, Missouri State University, June 12-14.

Kosovich, K., and R.T. Pavlowsky, 2012. Gravel sediment sources and bar distribution within the main stem of upper Bull Creek, southwest Missouri, Ozark Summit 2012, Missouri State University, June 12-14.

Mayus, A., M.R. Owen, H. Hoggard, and R.T. Pavlowsky, Urban water quality restoration in the metropolitan Springfield area, SW Missouri. Ozark Summit 2012, Missouri State University, June 12-14.

Olson, L.M., and R.T. Pavlowsky, Historical mine tailings inputs and their long-term effects on channel morphology and substrate, Big River, southeast Missouri. Ozark Summit 2012, Missouri State University, June 12-14.

Owen, M.R., and R.T. Pavlowsky, Water quality and forage production from municipal biosolids land application in southwest Missouri, Ozark Summit 2012, Missouri State University, June 12-14.

Owen, M.R., and R.T. Pavlowsky, Channel stabilization and riparian corridor enhancement in an urban stream, Springfield, Missouri. Ozark Summit 2012, Missouri State University, June 12-14.

Rudolph, J.H., J.D. Carroll, D. Beckman, and R.T. Pavlowsky, Coastal fishery restoration through implementation of a new national sanctuary program: Baseline fish and habitat surveys in Bluefields Bay. Ozark Summit 2012, Missouri State University, June 12-14.

Pavlowsky, R.T., M.R. Owen, and L.M. Olson, Geomorphic disturbance, mining contamination, and restoration implications for the Big River, southeastern Missouri, Ozark Summit 2012, Missouri State University, June 12-14.

Kosovich, K., and R.T. Pavlowsky, 2012. Gravel sediment sources and bar distribution within the main stem of upper Bull Creek, southwest Missouri, Upper Midwest Stream Restoration Symposium, Minneapolis, MN, March 4-7 2012 First Place, best poster presentation

Olson, L., and R.T. Pavlowsky, 2012. Effects of Historical Mine Tailings Inputs on Channel Morphology and Substrate, Big River, Southeast Missouri. Upper Midwest Stream Restoration Symposium, Minneapolis, MN, March 4-7 2012 Second Place, best poster presentation

Daugherty, N., and R.T. Pavlowsky, 2012. Nonpoint pollution sources and transport in rural Spring Creek, SW Missouri. 20<sup>th</sup> Annual Nonpoint Source Monitoring Workshop, Tulsa, OK, October 14-17.

Owen, M.R., L. Olson, and R.T. Pavlowsky, 2012. Assessment of nutrient and suspended sediment contributions from a subdivision development in Christian County, Missouri. 20<sup>th</sup> Annual Nonpoint Source Monitoring Workshop, Tulsa, OK, October 14-17.

Vaughan, A., and R.T. Pavlowsky, 2012. Urban water quality in the Springfield, Missouri Area: MS4 monitoring program. 20<sup>th</sup> Annual Nonpoint Source Monitoring Workshop, Tulsa, OK, October 14-17.

Owen, M.R., R.T. Pavlowsky, S.A. Lecce, and D.J. Martin, Local-scale variations in floodplain contamination by historical mining in the Old Lead Belt, se Missouri. 67<sup>th</sup> annual meeting of the the Southeastern Division of the Association of American Geographers, Asheville, North Carolina, November 18-20.

Pavlowsky, R.T., M.R. Owen, and D. Williams, Sediment PAH (Polycyclic Aromatic Hydrocarbon) contamination in an urban watershed and the influence of coal-tar sealant sources.

67<sup>th</sup> annual meeting of the the Southeastern Division of the Association of American Geographers, Asheville, North Carolina, November 18-20.

## **EDUCATION ACCOMPLISHMENTS**

OEWRI dedicates a significant amount of effort to training and research support for undergraduate and graduate 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. Activity logs show that OEWRI staff spend from 5 to 15 percent of their time per week training and mentoring students and assisting faculty in CNAS and other colleges at MSU. In 2012, OEWRI staff and facilities provided technical and educational resources for undergraduate and graduate students in several CNAS departments including GGP, BIO, and CHM, Darr School of Agriculture, and Department of Sociology, Anthropology, and Criminology in the College of Humanities and Public Affairs. A list of student training and education accomplishments supported by OEWRI follows below.

### **Hourly Student Workers (10)**

#### Undergraduate Students (6)

Jeremy Hines (CHM) Water quality laboratory Daniel Williams (GRY), GIS analysis  
Samantha Marshall (CHM), Water quality laboratory  
Terry Phillips (CHM), Urban stream quality & carbon transport, laboratory worker  
Aaron Pavlowsky (GGP), Sediment analysis and GPS/GIS support in Jamaica  
Erin Murray (BIO), Sediment analysis, Big River mining contamination project  
Micah Mayle (GGP), Water quality laboratory

#### Graduate Students (4)

Nicole Daugherty (GSS), Water quality laboratory  
Cora Arnall (GSS), Water quality monitoring technician  
Matt Grootens (GSS), Field Technician  
Megan Harrington (GSS), Field Technician

### **Undergraduate Student Research Projects (5 students)**

(1) Research projects in GRY 348-Geomorphology (Fall 2011) (3)

Tiana Smith (GRY) Precipitation affect on discharge for three Missouri springs, Dec 2012

Joshua Elson (GLG/GRY) Discharge and precipitation seasonal relationships of the Big River at Byrnes Mill , Missouri, Dec 2012

Sara Cheek (GLG/BIO), Temperature variation on Lake Springfield relative to the James River Power Station, Dec 2012.

(2) Intern Research Projects (*CNAS undergrad research showcase participants*) (2)

- (a) Erin Murray (BIO), Mining lead contamination in Big River sediments
- (b) Aaron Pavlowsky (GGP), Bluefields Bay Fish and Habitat Assessment Project

**Undergraduate Field Trips**

- GRY 348- Fall: Ward Branch channel assessment (1/2 day x 18 students)
- GRY 348-Fall: Soil Coring at Pearson Creek (1/2 day x 18)
- AGA 345-Fall: Soil Judging, use of coring truck and crew (1/2 day x 8)
- AGA 545- Spring: Soil Appraisal, use of coring truck and crew (1/2 day x 10)

**Graduate Thesis Research (21)**

OEWRI supports various levels of graduate student research at Missouri State University. The Institute entirely or partially supported 21 MS thesis projects in three programs: Geospatial Science (17), MNAS (3), and Biology (1) (see below). In addition, external funds for OEWRI projects provided graduate assistantships for 13 students and hourly work positions for 4 graduate students in 2012. These students and their programs are listed below.

<u>Graduated</u>	<u>2<sup>nd</sup> Year</u>	<u>1<sup>st</sup> Year</u>
Andrew DeWitt (GSS)	Kyle Kosovich (MNAS)	Virgil Cane (MNAS)
Megan Harrington (GSS)	Matt Grootens (GSS)	Aubree Vaughan (GSS)
Josh Rudolph (BIO)	Andrea Mayus (GSS)	Ezekiel Kuehn (GSS)
David Dickson (MNAS)	Malissa Nowack (GSS)	Cora Arnall (GSS)
	Lindsay Olson (GSS)	Mellora Hall (GSS)
	Nicole Daugherty (GSS)	Andrew Foremen (GSS)
	Andrew Schiller (GSS)	Mellora Hall (GSS)
	Kris Breckenridge (GSS)	
	Jennifer Carroll (GSS)	
	Tylene Coonts (GSS)	

**Graduate Assistantships (13)**

Andrew DeWitt (GSS), James River Runoff-319, Spring,

Anna Larkin (GSS), Non-Springfield MS-4, Spring  
Andrea Mayus (GSS), Urban Springfield 319 project, Spring, Summer, & Fall  
Lindsay Olson (GSS), Big River project, Spring, Summer, & Fall  
Megan Harrington (GSS), James River geomorphology project, Summer  
Nicole Daugherty (GSS), Water quality laboratory, Summer & Fall  
Kyle Kosovich (MNAS), Sediment Laboratory, Spring  
Josh Rudolph (BIO), Hydrologic monitoring/Jamaica project, Spring, Summer, & Fall  
Aubree Vaughan (GSS), Non-Springfield MS-4, Fall  
Ezekiel Kuehn (GSS), Viburnum Trend, Fall  
Virgil Cane (MNAS), Pearson Creek, Fall  
Matt Grootens (GSS), Big River, Summer  
Mellora Hall (GSS), Pearson Creek 319 project, Fall

#### **Completed MS Theses and Seminar Papers (4)**

- 1) DeWitt, Andrew, May 2012: Downstream changes in channel morphology and substrate in the Ozarks, James River, southwest Missouri (Geospatial Science)
- 2) Harrington, M, Dec 2012: Stream Discharge-Drainage Area Relationships in Missouri (Geospatial Science)
- 3) Rudolph, Joshua, Dec 2012: Effects of artificial reef implementation on fish populations in a marine protected area, Bluefields Bay, Jamaica (Biology)
- 4) Muchiri, Gitonga, Dec 2012: Water quality variations in storm-water runoff events in Christian County, Missouri (Geospatial Science) (*Seminar Paper*)

#### **National and Regional Student Presentations Awards (4)**

DeWitt, A., and R.T. Pavlowsky, Channel morphology regime equations for the James River, southwest Missouri Ozarks. Association of American Geographers annual meeting, New York, February 24-28. (Best MS oral paper, Geomorphology Specialty Group)

Kosovich, K., and R.T. Pavlowsky, 2012. Gravel sediment sources and bar distribution within the main stem of upper Bull Creek, southwest Missouri, Upper Midwest Stream Restoration Symposium, Minneapolis, MN, March 4-7 2012 First Place, best poster presentation

Olson, L., and R.T. Pavlowsky, 2012. Effects of Historical Mine Tailings Inputs on Channel Morphology and Substrate, Big River, Southeast Missouri. Upper Midwest Stream Restoration Symposium, Minneapolis, MN, March 4-7 2012 Second Place, best poster presentation.

DeWitt, A.R., and R.T. Pavlowsky, Channel morphology and substrate variability in the James River, Southwest Missouri, Missouri Natural Resources Conference, February 1-3, 2012, Tan-Tar-A Resort, Osage Beach, Missouri. (Best Student Poster by the American Fisheries Society.

### **Graduate-level Field Trips**

BIO 609- Spring (John Havel): Measurement of channel properties and flow (1/2 day x 8)  
GEO 770-Summer (Pavlowsky): Viburnum Trend channel assessment (6 days x 12)

### **SERVICE AND OUTREACH ACCOMPLISHMENTS**

Service and community outreach is an important component of OEWRI's mission. The Institute is an "on-call" campus resource for technical advice and support and overall this type of service accounts for about 10% of staff workload. Examples of these types of activities include OEWRI loaning field equipment to Drs. Black (GGP) and Barnhart (BIO), providing research topic presentations in Dr. Pavlowsky's GRY 348 and Dr. Meyer's GEO 700 courses, and generating water analyses to support Dr. Biagioni's laboratory projects. Examples of other types of service and outreach activities by OEWRI are described below:

#### **Environmental Events**

Director- James River water quality trends, CNAS public lecture series Feb 14, 2012

Director- Presentation of Sediment PAH study to Springfield City Council.

Director- Panel presenter, Drought Forum, Watershed Committee of the Ozarks monthly meeting, Springfield, MO, September 7.

Director-Report on "Emergency use of municipal wastewater for gray water supply in Springfield" to Southwest Wastewater Treatment Plant, Springfield, August 29.

Attended 2012 Missouri Natural Resources Conference, Osage Beach, Missouri, February 1-3, 2012.

#### **Teaching Support at MSU**

Operated truck-mounted Giddings soil probe for a field trip in GRY 348 *Geomorphology* (Pavlowsky), Fall 2012.

Staff taught lab session on stream discharge and channel capacity in GRY 348 *Geomorphology* (Pavlowsky), Fall 2011.

Staff trained students how to survey stream channels in GRY 348 *Geomorphology* (Pavlowsky), Fall 2011.

Staff gave presentation to GEO 700 *Introduction to Graduate Study in Geospatial Science* (Meyer) in GGP, Fall 2011

Staff trained students how to survey stream channels in GEO 770 *Advanced Field and Laboratory Methods* (Pavlowsky), Summer 2011.

Recorded and reported mileage records and coordinated maintenance on OEWRI and GGP vehicles.

Provided technical assistance and water quality analyses for Project Wet summer program.

Provide technical support to Drs. Black (GGP), Dr Biagioni (CHM), Mantei (GGP), and Gouzie (GGP)

### **Geospatial Technology Support**

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.

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

GGP GIS Support: OEWRI provides GPS receivers and related equipment for several courses offered by the department.

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.

### **Regional Outreach**

Examples of community outreach and related committee work include the following:

Director is a member of the Future of Water Committee, a subcommittee of the Good Community Committee for the City of Springfield

Director is a member of the Conservation Planning Advisory group for the upper Meramec River watershed which is sponsored by The Nature Conservancy.

Director was a member of the Ozark Summit 2012 “Restoration in the 21<sup>st</sup> Century” planning committee for a regional conference on ecological restoration held on campus on June 12-14.

Director lead an effort to bring MSU students and provide community assistance and technical support for fish sanctuary and watershed assessments in Bluefields Bay, Jamaica in partnership with Dan Beckman in Biology.

Director and Linnea Iantria (GGP) provided community assistance and technical support to develop a tourism masterplan for Bluefields Bay and Treasure Beach communities in Jamaica.

Director published invited op-ed essay “Missouri’s endangered water resources need everyone’s help” published in Springfield News-Leader and Kansas City Star, April 2012.

## **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 2012, OEWRI worked with the following agencies and groups:

### **Regional Environmental Groups (7)**

Watershed Committee of the Ozarks, Stacey Armstrong  
James River Basin Partnership, Joseph Pitts  
Upper White River Basin Foundation, David Casaletto  
Table Rock Lake Water Quality, Inc., Gopala Borchelt  
The Nature Conservancy, Steven Herrington  
Ozark Regional Land Trust, Abigail Lambert  
Big River Watershed Group, Michael Andresini

### **Government Agencies (8)**

Environmental Protection Agency, Region 7  
Missouri Department of Natural Resources  
Missouri Department of Conservation  
National Resources Conservation Service  
Southern Missouri Water Quality Project  
Greene County Soil and Water District  
USGS-Water Resources Program (Rolla. MO)  
U.S. Fish and Wildlife Service

### **Universities (4)**

University of Missouri-Columbia  
Missouri University of Science and Technology  
East Carolina University  
Drury University

### **Local Governments (9)**

Greene County  
Christian County  
City of Springfield  
City of Nixa  
City of Ozark  
City of Battlefield  
City Utilities of Springfield  
City of Bolivar  
City of Ava

### **Private Companies (1)**

Olsson Associates

### **Missouri State University Centers (4)**

Center for Resources Planning and Management  
Darr Agricultural Center  
Center for Biomedical and Life Sciences  
Bullshoals Field Station/Project Wet

### **Faculty Collaborators at MSU (7)**

Tom Dewitt, Agriculture  
Chris Barnhart, Biology  
Dan Beckman, Biology  
Paul Durham, Biology  
Doug Gouzie, Geology  
William Wedenoja, Anthropology  
Linnea Iantria, Geotourism

## **PUBLIC AFFAIRS ACTIVITIES**

OEWRI supports the Public Affairs Mission of MSU. Below are several examples of Public Affairs accomplishments for 2012.

Cultural Competence. OEWRI has extended its outreach and research program to the southwest coast of Jamaica on Bluefields Bay. MSU faculty, graduate students, and undergraduate students are working within local communities alongside citizen groups to address economic and environmental problems. The goal is to develop a sustainable economy that combines natural resource use with conservation activities including environmental education. Critical to the

sustainable goal is the development of geotourism opportunities, better water treatment facilities, improved marine fishery stocks, and soil and water conservation practices that result in both sufficient crop production and reduced soil erosion and runoff problems.

MSU faculty Bill Wedenoja (ANT), Dan Beckman (BIO), and Linnea Iantria (GGP) worked with OEWRI to assist Bluefields Bay community groups in their goal of developing a better future for their community and children. OEWRI is providing water quality, soil management, and mapping expertise to the partnership. In 2012, Pavlowsky lead one study-away student group and two graduate/undergraduate research trips to address marine conservation, water quality, and geotourism in Jamaica. With the financial support of the Latin American, Caribbean, and Hispanic Studies program and faculty research grants at MSU, OEWRI, GGP, and the Biology Department has been working on a pilot study to determine the baseline condition of the fishery and habitat quality in Bluefields Bay Fish Sanctuary. Two GSS MS theses have previously been completed in support of these efforts in 2010. In December 2012, a thesis on the effects of artificial reefs on fish populations was completed by Joshua Rudolph in Biology. Another thesis in GGP was completed in May 2013 on mapping of habitat including coral reefs in Bluefields Bayt. Pavlowsky has a new graduate student beginning in Fall 2013 who plans to complete a thesis on beach erosion along the south coast of Jamaica.

Ethical Leadership. OEWRI gives students a chance to work in the field of environmental management and research along side of faculty and government managers. They get to work on projects in support of environmental leadership goals and ethical decision-making. There are two projects that showcase this element in the Institute's accomplishments.

First, the MS-4 urban stream water quality monitoring program allows OEWRI to take a leadership role in addressing water management regulations for the City of Springfield and other urban areas in Greene County. We operate and report on a 32 site water quality monitoring network aimed at sampling nutrient, sediment, and chloride concentrations in storm runoff. The results of student run field monitoring and laboratory analyses are used to guide water quality management plans where students get to interact with state and local environmental managers. In addition, the data collected is being stored and evaluated by OEWRI to get as much scientific knowledge from the data as possible, rather than let it become buried in regulatory agency files. The collaborative aspect of this project helps our students to get hands-on experience in water quality monitoring, reduces the cost for regulatory compliance to the communities, and expands the utility of the data with research for the public good.

Second, the Big River sediment contamination study addresses questions about the degree and spatial extent of lead contamination in sediments from the Big River in eastern Missouri due to mine tailings inputs from the Old Lead Belt mining area which closed in 1972. OEWRI has become the leader on mining contamination problems in association within one of the largest

Superfund sites in nation. Our students get opportunities to attend meetings with Federal environmental officials and managers where the results of our studies are being showcased to affect the decision-making process involved with management plans for the Big River. These plans address the toxic risks of contaminated sediment and water to aquatic life and human health. This work was expanded to include the Viburnum Trend mining area in SE Missouri in 2012.

Community Engagement. OEWRI is constantly out in the community working with partners and responding to new environmental challenges. Recall the long list of partners involved with OEWRI described above. Due to training and networking on projects, several OEWRI graduates have been hired by local watershed groups and local and state environmental agencies.

### **UNIVERSITY BUDGET EXPENDITURES AND INCOME**

In addition to external grant funding, OEWRI is allocated about \$75,000 annually by the University to support staff and operations. The university dedicated these funds to OEWRI to provide match support for federal start-up funding and to add long-term stability to the operation of the Institute. The budgeting of these funds is generally distributed as follows: (i) full-time staff person, 67%; (ii) supplemental salary for the director, 13%; (iii) administrative and laboratory supplies, 15%; and (iv) emergency reserve, vehicle maintenance, and instrumentation operations, 5%.

The university budget allocation to OEWRI is leveraged to produce benefits beyond base funding in three ways: (i) salary match for federal grants; (ii) additional service time; and (iii) equivalent credit hour generation. OEWRI generates from 3 to 4 times the university budget annually included grants and fund leveraging for education and service benefits. An approximate accounting of additional cost benefits is provided below.

Match. State funds can be used to provide salary match on some environmental grants, the Federal 319 nonpoint source grants in particular require a 40% match in the total budget. OEWRI matches at least 25K annually to these types of grants.

Service Time. Activity logs for OEWRI staff indicate that 10% of the weekly workload is related to service to MSU. If a 10% return on staff time and annual staff salary of 34K is assumed, then three full-time staff generate about 13K in service benefits beyond project funding.

Credit Hour Generation. OEWRI staff are precluded from teaching courses at MSU under present funding line conditions. However, they contribute significantly to credit hour generation through mentoring, research projects, and field trips for undergraduate and graduate students.

Given the educational accomplishments described above, the dollar value of these benefits can be estimated. Typically, annual credit hour support generates about 15k to 20k in benefit for CNAS.

### **GOALS AND STRATEGIC PLAN FOR 2013**

OEWRI plan's is to continue on its present course of action and schedule of activities. The following six goals will help further support the mission of OEWRI:

- (1) Continue to attract externally-funded projects.
- (2) Continue to support and mentor undergraduate and graduate research.
- (3) OEWRI effectiveness is limited by space limitations. OEWRI will work with CNAS and GGP to find more space.
- (4) Continue to focus on peer-reviewed publication as an outlet for research project results. Through publication, OEWRI's reputation in the field can grow and it can be more competitive for basic research grant funding in the future.
- (5) Maintain and regularly update the OEWRI website as a major communication and data outlet.
- (6) Try to find ways to get more faculty into principal investigator roles in OEWRI. Research analysis and writing is a bottleneck for productivity.
- (7) Expand partnerships with centers and research groups at MSU.

### **SPACE AND STAFFING NEEDS**

Given the level of productivity of OEWRI and its lack of sufficient space to house staff, students, laboratories, and field equipment, four additional types of spaces are needed by OEWRI to improve productivity, working conditions, and safety:

- (1) Sediment laboratory space (15' x 20') is needed for sediment sample preparation and analysis to support recent instrumentation acquisitions and funded research activities. It does not need a hood, but a running hot and cold sink would be very useful ("dirty lab").

(2) Water quality laboratory space (15' x 20') is needed that has a fume hood and sink. Present facilities are not adequately ventilated for the number of staff and students working in the present laboratory. In addition, presently there is not enough space to house the activities required to adequately support the instrumentation and externally funded research projects for OEWRI ("clean lab").

(3) Field equipment and supplies space (20' x 20') is needed to have access to the outside so that field monitoring activities effectively organized and outfitted. Presently, water quality laboratory, sediment quality laboratory, and field activities are run out of one laboratory. Ideally, this space may be part of a larger double-bay garage so that the truck mounted coring rig for which OEWRI presently operates can be shielded from the weather and vandalism ("Field monitoring garage").

(4) OEWRI office space (10' x 10') to support Director's administration and research time.

OEWRI needs more technical faculty in the environmental field of hydrology and water quality to increase its productivity over present levels. This position needs to be full- or half-time faculty position (PhD) with expertise in hydrology and water quality modeling with 50% time supporting OEWRI research and education. This expertise is particularly needed to address water quality needs in the region and attract more external funds. Further this line could help support physical geography faculty load for undergrad major and thesis advisement.