

Missouri State University
College of Applied and Natural Sciences

Ozarks Environmental and Water Resources Institute

ANNUAL REPORT 2006

By: Dr. Robert T. Pavlowsky, Director
bobpavlowsky@missouristate.edu

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I. INTRODUCTION

The Ozarks Environmental and Water Resources Institute (OEWRI) was established in January 2004 by the MSU Board of Governors and the first director was hired in March 2005 (Pavlowsky). OEWRI's mission is to improve the scientific understanding of environmental problems involving water resource quantity, quality, and distribution in Ozark watersheds. It serves its mission by providing a hub for collaborative research projects in the areas of water and sediment quality, hydrology, environmental geology, and land use change. The scope of inquiry is at the interface of the water cycle, environment, and society at or near the watershed surface involving the physical and biological aspects of river, lake, soil, and karst systems. Additional information about OEWRI can be found at the following website:
<http://www.oewri.missouristate.edu/>.

OEWRI staffing includes the following:

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

OEWRI is housed in Temple Hall as follows:

- 1) Director's office- T321;
- 2) Staff offices- T326 and T343;
- 3) Nutrient laboratory- T470 (shared with Dr. Richard Biagioni in Chemistry);
- 4) Metals/ICP-AES laboratory-T437 (shared with Chemistry);
- 5) Caves and Karst laboratory T329 (shared with Dr. Douglas Gouzie in Geography, Geology, and Planning);

- 6) Microbiology laboratory- T239 (shared with Dr. John Steiert in Biology);
- 7) Geomorphology Laboratory- T125 (shared with Dr. Robert Pavlowsky in Geography, Geology, and Planning); and
- 8) Sample Preparation Laboratory- T129 (shared with Geography, Geology, and Planning).

Presently, OEWRI is involved in three parallel running activities that are directly related to its research mission: (i) center start-up; (ii) present project activities; and (iii) future project development. Start-up involves the hiring and training of staff and student workers, renovation of offices and laboratory space, acquisition of outdoors areas for field equipment, meetings with administrators and sales representatives, purchase and fitting of instrumentation for laboratories, researching and acquisition of supplies to support the development of standard methods for use in environmental monitoring and research, developing a collaborative faculty research base at MSU, and organizing advisory committees.

Present project activities involve the planning, implementation, and completion of externally funded projects that were on-going at the time of OEWRI establishment or awarded since then. Active project activities involve the planning of the project, organization of human and supply resources, meetings with sponsors and collaborators, coordination of field logistics, training of staff and students, quality assurance/quality control procedures, analytical instrumentation operation and maintenance, data collection and management, data analysis, and report writing. Future project development involves looking for new opportunities for new funded projects in the Ozarks and beyond. Time and effort is spent on meetings with potential sponsors and collaborators, grant proposal writing and submission, environmental networking, and innovative application of OEWRI resources to meet the needs of project plans.

Beyond supporting the direct activities of the institute, significant amount of time and effort is used to support the university's mission in public affairs. For OEWRI, public affairs activities in the science and environment theme usually include: (i) speaking engagements to talk about the general aspects of environmental problems and solutions to watershed stakeholders; (ii) technical assistance to various agencies, not-for-profit groups, and citizen groups; (iii) outreach of environmental knowledge and technical training to MSU students and faculty; and (iv) public assistance involving inquiries relating to environmental issues in the Ozarks.

This report presents the activities of OEWRI for calendar year 2006. In addition, since this is the first annual report submitted by the institute, information on its activities during the calendar years of 2004 and 2005 will also be included where appropriate.

II. ACADEMIC PROGRAMS

Undergraduate and Graduate Technical Assistance

OEWRI staff are a resource for undergraduate and graduate students in the department of Geography, Geology, and Planning. Since staff offices are located on the third floor among the classrooms and faculty offices of the Department of Geography, Geology, and Planning, it is only reasonable to expect that OEWRI supports the curriculum and teaching activities through technical assistance, research methodologies, and environmental database access.

Undergraduate Workers

OEWRI presently employs six undergraduate students at \$7/hour to help with laboratory analyses and field work. Their names and majors are:

Water Analysis

Robert Powers, Chemistry Education

Kristin Clegg, Biology

Soil Analysis

Keven Mckee, Chemistry Education

Sarah Bunton, Agriculture

Field Surveys

Amanda Williams, Geography

Gill Gones, Planning

Graduate Assistantships

OEWRI projects provided graduate assistantships for 12 students in two programs (Biology and Geospatial Science) in 2006 (Table 1). Twelve graduate assistantships were provided in 2004 and 16 in 2005 for students within four graduate programs (Biology, Chemistry, Geospatial Science, and Natural and Applied Sciences). A list of the students and their program follows:

Graduate Theses

Thesis production for OEWRI projects trends as 1 for 2004, 6 for 2005, and 5 for 2006 and include graduated students in four programs (Biology, Chemistry, Geospatial Science, and Natural and Applied Sciences) (Table 2).

III. RESEARCH AND SCHOLARSHIP

Publications

OEWRI projects produced two published peer-reviewed journal articles in 2006, with 3 in 2004 and 2 in 2005 (Table 3).

Presentations

OEWRI projects produced 7 presentations in 2004, 20 in 2005, and 34 in 2006 (Table 4).

Funded Research

OEWRI principal investigators received 25 externally-funded grants totaling over \$1,255,000 for the three year period from 2004 to 2006 (Table 5). This breaks down to 4 projects for \$110,000 for 2004, 16 projects at \$400,000 for 2005, and 9 projects at \$745,000 for 2006. The 2006 total includes a \$496,000 grant from the USEPA to use for start-up funding. Four OEWRI grant proposals were denied during the same period.

Collaborations and Partnerships

One of the 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. OEWRI has partnered or collaborated with 10 government agencies, 5 watershed

groups, 4 universities, and 2 private firms (Table 6). In terms of on-campus collaboration, OEWRI has worked with 14 faculty from four departments and with three other MSU centers including the Center for Resource Planning and Management, Center for Archeological Research, and Bull Shoals Field Station (Table 6).

Research Promotion

One of the main goals of OEWRI is to promote and initiate cooperative research projects in water and sediment quality. Three examples of promotion efforts by OEWRI in 2006 are described below:

1) Incentive grant with biology- OEWRI submitted a successful research incentive grant with John Steiert (Microbiology) and Paul Durham (Cell biology and Life Sciences) to the MSU administration to that will fund a bacterial typing instrument (iPCR) and supplies needed to run the laboratory. This instrument has wide application in biological sciences, but it planned that OEWRI will oversee a pilot study to use the new instrumentation to detect the sources of bacteria in Ozark springs and streams.

2) Precision agriculture initiative- OEWRI worked along side the Department of Agriculture and other departments at MSU to take the lead and craft a precision agriculture white paper to fund a remote sensing and GIS initiative to study and manage small-scale crop production in the central Ozarks through the MSU Fruit Experiment Station. While the proposal has yet to be successful, it was an attempt by OEWRI and the CNAS as a whole to work together to promote research at MSU.

3) Lincoln University environmental science forum- OEWRI took parting in two events sponsored by Lincoln University and the Army Research Office. The first event involved an environmental research workshop held at Ft. Leonard Wood on November 29-30, 2005. The second event was the Student Environmental Science Exploration Summit held at Lincoln University on May 15-19, 2006. Both of these events focused on bringing MSU and other Missouri university researchers together to develop research interests in the areas of military needs and to involve Lincoln University students in these projects as well as graduate school recruitment within Missouri in general.

Faculty and Student Awards

In 2005, the director of OEWRI (Pavlowsky) was recognized at a home basketball game in the “Signature Bank Academic Spotlight” in honor of outstanding accomplishments by MSU faculty. Graduate assistants in the department of Biology won two “best paper” awards in 2005 and one in 2006 on topics dealing with OEWRI projects (Table 4). Graduate students working on OEWRI project won seven awards, 4 in 2005 and 3 in 2006 (Table 7).

IV. PUBLIC AFFAIRS AND COMMUNITY OUTREACH

OEWRI has given seven public affairs presentations including 3 in 2006 (Table 8).

V. RESOURCE DEVELOPMENT

Staff

Two new staff members were hired in 2006. A new Project Supervisor, Heather Hoggard, was hired in late Fall 2006, replacing James Richburg who left the position. Richburg was hired in late Fall 2005 along with the other current Project Supervisor, Marc Owen. A Research Specialist, Derek Martin, was also hired in late Fall but started in early 2006. Presently, OEWRI has three full-time staff and a half-time director.

Fiscal/Budgets

OEWRI is funded by an annual university budget of \$70,000 and external funds from grants and subcontracts.

Infrastructure

OEWRI purchased new office furniture and benches for Temple 328 in early 2006 and Temple 343 in early 2007. New laboratory benches and cabinets were also put into Temple 125. Analytical instrumentation was also purchased by OEWRI. A Lachate nutrient analyzer (70k) was purchased for Temple 470. A CNS analyzer (40k) and laser particle sizer (60k) was purchased for Temple 125. It is planned for additional purchases of a portable XRF analyzer for soil samples and a Total inorganic carbon/Total organic carbon analyzer for water samples this Spring.

Start-up Funds

A 500k appropriation by Senators Talent and Bond supported a grant from the U.S. EPA to fund general start-up activities for OEWRI. The grant has the following objectives:

1. Provide infrastructure and develop office and laboratory space;
2. Develop facilities, instrumentation, and capacity for scientific water and soil/sediment monitoring and analysis through phase 1 plan for acquisition of equipment and supplies for water and sediment quality activities;
3. Develop EPA-approved Quality Assurance Program Plans (QAPPs) and Standard Operating Procedures (SOPs) for all laboratory/analytical, field monitoring, and geospatial techniques to support phase 1 aims to support water and sediment analysis;
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;
5. Develop and support environmental and water resource website services including data delivery and communication systems;
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; and
7. Host and sponsor one water research and resources conference for the Ozarks region.

Table 1: Graduate Assistantship Production by OEWRI Projects (2004-2006)

2004 = 12

Maya Williamson, Geospatial science
Derek Martin, Geospatial science
Ron Miller, Geospatial science
Mark Bowen, Geospatial science
Alyson Milhalenko, Geospatial science
Aaron Nickolotsky, Geospatial science
Briana Kaiser, Biology
Ben Dodd, Biology
Kim Medley, Biology
Jeff Kimmons, Biology
Alison Bellar, Biology
Mary Krause, Chemistry

2005 = 16

Aaron Nickolotsky, Geospatial science
Mark Gossard, Geospatial science
Gopala Borchelt, Geospatial science
Ron Miller, Geospatial science
Maya Williamson, Geospatial science
Derek Martin, Geospatial science
Stacey Armstrong, Geospatial science
Michael Addis, Natural and applied science
Matt Peters, Geospatial science
Jolen Bowers, Biology
Briana Kaiser, Biology
Ben Dodd, Biology
Kim Medley, Biology
Jeff Kimmons, Biology
Alison Bellar, Biology
Tim Davis, Applied and Natural Sciences

2006=12

Gopala Borchelt, Geospatial science
Stacey Armstrong, Geospatial science
Arindam Mukherjee, Geospatial science
Mark Gossard, Geospatial science
Matt Peters, Geospatial science
Brandi Gerik, Biology
Jennifer Duzan, Biology
Zachary Beussink, Biology
Todd Fobian, Biology
Jason Wolf, Biology

Kelli Dickerson, Biology
Jolen Bowers, Biology

Table 2: Master's Thesis Production by OEWRI Projects(2004-2006)

2004=1

Bowen, M., 2004, Consequences of Valley Mill Reservoir drainage and downstream water quality (resource planning)

2005=6

Rodgers, W., 2005, Mercury contamination of channel and floodplain sediments in Wilson Creek Watershed, Southwest Missouri (geospatial science)

Martin, D., 2005, Geospatial analysis of gravel bar deposition and channel migration within the Ozark National Scenic Riverways (geospatial science)

Nickolotsky, A., 2005, Step-pool morphology of a wilderness headwater stream of the Buffalo River, Arkansas (geospatial science)

Krause, M., 2005 Jordan creek baseline water quality project: development of analytical methods (chemistry)

Kaiser, B., 2005. The effects of glochidiosis on fish respiration. Master of Science, Missouri State University. (biology)

Dodd, B., 2005. Immune responses of host fish to the parasitic glochidia larvae of Unionid mussels. Master of Science, Missouri State University (biology)

2006=5

Miller, R., 2006, Nutrient loads and sources in the urbanized Jordan-Wilson Creek watershed (geospatial science)

Davis, T., 2006, Soil phosphorus levels in residential lawns and comparisons among four and land uses in Springfield, Missouri (natural and applied science)

Hunsinger-Nelson, T., 2006, Spatiotemporal patterns of transitional landscapes in the southwest Missouri Ozarks (geospatial science)

Woosley, R., 2006, Classification and Prediction of impervious surfaces in the Brush Creek Watershed, Missouri (geospatial science)

Bowers, J., 2006. Innate cross-immunity of host fish to the parasitic larvae of Unionid mussels. Master of Science, Missouri State University. (biology)

Table 3: OEWRI Project Production of Peer-Reviewed Journal Articles(2004-2006)

2004 = 3

Horton, K., and R.T. Pavlowsky, 2004. *Assessment of recreation impacts on wilderness campsites, Mark Twain National Forest, Missouri*: In, K. Bricker and S.J. Millington (eds.), Proceedings of the 2004 Northeastern Recreation Research Symposium, March 28-30, 2004, Bolton Landing, New York. General Technical Report NE-326, USDA Forest Service, Northeastern Research Station.

Pavlowsky, R.T., 2004. *Urban impacts on Ozarks Streams*: In, Self Sustaining Solutions for Streams, Watersheds, and Wetlands, Proceedings of the September 2004 Conference, American Society of Agricultural Engineers.

S.A. Lecce, S.A., and R.T. Pavlowsky, 2004. *Spatial and Temporal Variations in the grain-size characteristics of historical floodplain deposits, Blue River, Wisconsin, USA*: *Geomorphology* 61(3/4):361-372.

2005 = 2

Dodd, B.J., M.C. Barnhart, C.L. Rogers-Lowery, T.B. Fobian, and R.V. Dimock Jr. 2005. Cross-resistance of largemouth bass to glochidia of unionid mussels. *Journal of Parasitology* 91(5):1064-1073.

Ingersoll, C.M., M.C. Barnhart, and 20 others. 2005. Standard guide for conducting laboratory toxicity tests with freshwater mussels (E2455-05). ASTM International Annual Book of Standards Volume 11.05, West Conshohocken, PA. 51 pages.

2006 = 2

Dodd, B.J., M.C. Barnhart, C. L. Rogers-Lowery, T.B. Fobian, and R.V. Dimock Jr. 2006. Persistence of acquired immunity of largemouth bass to glochidia of unionid mussels. *Journal of Fish and Shellfish Immunity* 21:473-484.

Barnhart, M.C. 2006. A compact system for rearing juvenile freshwater bivalves. *Aquaculture* 254:227-233. doi:10.1016/j.aquaculture.2005.08.028.

Table 4: OEWRI Project Production of Conference Presentations 2004-2006.

2004 = 7

Rodgers, W., R.T. Pavlowsky, and J. Ritchie, 2004. *Mercury Distribution and source identification using geochemical surveys and cesium-137 dating of fluvial sediments*. Association of American Geographers Annual Meeting, Philadelphia, PA, March 13-19.

Pavlowsky, R.T., 2004. *Urban influence on Ozark stream channels*. Association of American Geographers Annual Meeting, Philadelphia, PA, March 13-19.

Shade, K., R.T. Pavlowsky, and Jerry Ritchie, 2004. *Historical water quality trends using the alluvial sedimentary record, Wilson Creek National Battlefield, Missouri*. Association of American Geographers Annual Meeting, Philadelphia, PA, March 13-19.

Horton, K., 2004. *Assessment of recreation impacts on wilderness campsites, Mark Twain National Forest, Missouri*: 16th Northeastern Recreation Research Symposium, March 28-30, 2004, Syracuse, NY.

Pavlowsky, R.T., 2004. *Urban impacts on Ozarks Streams: Self Sustaining Solutions for Streams, Watersheds, and Wetlands Conference*, American Society of Agricultural Engineers, September 12-15, 2004, Minneapolis, MN.

Havel, J.E., K.A. Medley, and R.G. Rhodes, 2004. *Spatial distribution and dynamics of algae blooms in Table Rock Lake*. Great Plains Limnologists, Springfield, Missouri.

Havel, J.E., and R.G. Rhodes, 2004. *Spatial distribution and dynamics of algae blooms in Table Rock Lake, James River arm*. Coordination Meeting, Missouri Department of Natural Resources, Springfield, Missouri.

2005 = 20

Rodgers, W and R.T. Pavlowsky, 2005. *Sources and history of mercury contamination in channel and bank sediments of Wilson Creek and its tributaries, Springfield, MO*: Missouri Natural Resource Conference, February 2-4, Tan-Tar-A Resort, Osage beach, Mo.

Pavlowsky, R.T., and M. Bowen, 2005. *Within-reach variability of Ozark stream morphology*. Association of American Geographers Annual Meeting, Denver, CO, April 5-9.

Havel, J.E., and K.A. Medley, 2005. *Zooplankton as bioindicators: diversity and abundance in the Missouri River*. Great Plains Limnologists, Lawrence Kansas (2005).

Jack, J. D., K. A. Medley, and J.E. Havel, 2005. *Zooplankton as potential indicators of biotic condition in large rivers*. Ohio River Basin Consortium, Louisville, Kentucky (2005)

Medley, K.A., J.E. Havel, and J.D. Jack, 2005. *Zooplankton as potential indicators of biotic condition in large rivers*. North American Benthological Society, New Orleans, Louisiana.

Barnhart, M. C. 2005. Host use and host abuse among the Unionidae. University of Michigan, Michigan Museum of Zoology. **INVITED**

Barnhart, M. C. 2005. Overview of North American freshwater mussels. U. S. Environmental Protection Agency Mussel Toxicity Testing Workshop, Chicago IL, 8/23-24. **INVITED**

Kaiser, Brianna and M. C. Barnhart. 2005. Effects of hypoxia on Unionid mussels. U. S. Environmental Protection Agency Mussel Toxicity Testing Workshop, Chicago IL, 8/23-24. **INVITED**

Barnhart, M. C. 2005. Extinction and the life history of unionid bivalves. Symposium: From Development to extinction: Molluscan Neontology and Paleontology. Joint Conference of the American Malacological Society and the Western Society of Malacologists, Asilomar, CA **INVITED**

Barnhart, M.C. and B. Roston. 2005. Host infection strategy of the snuffbox mussel, *Epioblasma triquetra*. 2005. Platform, Biennial Symposium of the Freshwater Mollusc Conservation Society, St. Paul MN.

Kaiser, B.E. and M.C. Barnhart. 2005. The effects of glochidiosis on fish respiration. Platform, Biennial Symposium of the Freshwater Mollusc Conservation Society, St. Paul MN.

Dodd, B.J., M.C. Barnhart, C. Rogers-Lowery, T. Fobian, R.V. Dimock 2005. Persistence of acquired resistance of largemouth bass to glochidia of a unionid mussel. Poster, Biennial Symposium of the Freshwater Mollusc Conservation Society, St. Paul MN. **BEST STUDENT POSTER AWARD.**

Dodd, B.J., M.C. Barnhart, C. Rogers-Lowery, T. Fobian, R.V. Dimock 2005. Cross-resistance of largemouth bass to glochidia of unionid mussels. Platform, Biennial Symposium of the Freshwater Mollusc Conservation Society, St. Paul MN

Serb, J.M., M. C. Barnhart, and J.L. Harris. 2005. Identifying new populations of the endangered winged mapleleaf *Quadrula fragosa* using molecules and morphology. Platform, Biennial Symposium of the Freshwater Mollusc Conservation Society, St. Paul MN

Bringolf, R. B., M.C. Barnhart et al. 2005. Assessing the hazards of current use pesticides to early life stages of native freshwater mussels. Platform, Biennial Symposium of the Freshwater Mollusc Conservation Society, St. Paul MN.

Wang, N., T. Augsberger, C. Barnhart et al. 2005. Developing standardized guidance for conducting toxicity tests with the early life-stages of freshwater mussels. Platform, Biennial Symposium of the Freshwater Mollusc Conservation Society, St. Paul MN.

Barnhart, M.C. 2005. Culture methods for native freshwater mussels: How to make buckets of muckets. Joint meeting, Mid-Continent Warmwater Fish Culture Workshop and Missouri Aquaculture Association. Blue Springs, MO. **INVITED**

Barnhart, Chris, Kenda Flores, and Rob Pulliam. 2005. Buried treasure: the conservation significance of native mussels. Platform presentation, Missouri Natural Resources Conference, Lake Ozark, MO.

Kaiser, Brianna, and Chris Barnhart. 2005. The effects of glochidiosis on fish respiration. Platform presentation, Missouri Natural Resources Conference, Lake Ozark, MO. **BEST STUDENT PRESENTATION AWARD**, MO Chapter, American Fisheries Society.

Fobian, Todd, Ben Dodd, and Chris Barnhart. 2005. Cross-resistance of host fish to several species of mussel glochidia. Platform presentation, Missouri Natural Resources Conference, Lake Ozark, MO.

2006 = 34

Borchelt, G., and R.T. Pavlowsky, 2006. *Nutrient concentrations during baseflow conditions in rivers within the upper White River Basin*: Missouri Natural Resource Conference, February 1-3, Tan-Tar-A Resort, Osage beach, Mo.

Davis, T., and R.T. Pavlowsky, 2006. *Soil phosphorus levels in residential lawns in Springfield, Missouri: comparisons with other turfgrass systems*: Missouri Natural Resource Conference, February 1-3, Tan-Tar-A Resort, Osage beach, Mo.

Gray, J., and R.T. Pavlowsky, 2006. *Geomorphic assessment and restoration of a small urban Ozark stream*: Missouri Natural Resource Conference, February 1-3, Tan-Tar-A Resort, Osage beach, Mo.

Gossard, M., and R.T. Pavlowsky, 2006. *Geomorphic assessment and restoration plan for the Ward Branch restoration project, Springfield, Missouri*: Missouri Natural Resource Conference, February 1-3, Tan-Tar-A Resort, Osage beach, Mo.

Pavlowsky, R.T., 2006. *Geomorphic assessment and restoration plans for the Ward Branch Restoration Project, Springfield, Missouri*: Association of American Geographers Annual Meeting, Chicago, IL, March 7-11.

Borchelt, G., and R.T. Pavlowsky, 2006. *Nutrient concentrations in streams and their relationship to geology and land-use in the Upper White River Basin*: Association of American Geographers Annual Meeting, Chicago, IL, March 7-11.

Armstrong, S., and R.T. Pavlowsky, 2006. *Detention basin influence on Ozarks stream stability*: Association of American Geographers Annual Meeting, Chicago, IL, March 7-11.

Armstrong, S., R.T. Pavlowsky, and M. Owen, 2006. *Geomorphological History and Analysis of an Urbanizing Karst Catchment*. 37th Binghamton Geomorphology Symposium on The Human Role in Changing Fluvial Systems, October 20-22, Columbia, SC.

Gossard, M.A., R.T. Pavlowsky, and M.R. Owen, 2006. *Sediment budget approach to evaluate urban-related instability in an Ozark Stream*. 37th Binghamton Geomorphology Symposium on The Human Role in Changing Fluvial Systems, October 20-22, Columbia, SC.

Lecce, S.A., R.T. Pavlowsky, and G.J. Schlomer, 2006. *Mercury contamination of floodplain sediments from historic gold mining in North Carolina*: 37th Binghamton Geomorphology Symposium on The Human Role in Changing Fluvial Systems, October 20-22, Columbia, SC.

Schlomer, G.J., R.T. Pavlowsky, and S.A. Lecce, 2006. Use of gold mining-related mercury in geochemical profiles to investigate timing and rates of historical floodplain sedimentation in the North Carolina Piedmont. 37th Binghamton Geomorphology Symposium on The Human Role in Changing Fluvial Systems, October 20-22, Columbia, SC.

Bukaveckas, P.A, J.E. Havel, et al., 2006. Zooplankton communities and chemical properties of suspended particulate matter as tools for river monitoring and assessment. EPA EMAP, Duluth, Minnesota.

Havel, J.E., 2006. Diversity and abundance of zooplankton in the Missouri River. Great Plains Limnologists, Konza Prairie, Kansas

Dickerson, K.R., and J.E. Havel, 2006. Zooplankton swimming behavior and refuge use in flowing water. Great Plains Limnologists, Konza Prairie, Kansas

Havel, J.E., K.A. Medley, and K.D. Dickerson, 2006. Longitudinal trends in zooplankton communities in the Missouri River. Ecological Society of America, Memphis, Tennessee.

Levchuk, A, J.E. Havel, J. Jack, K.A. Medley, and J. Chick, 2006. . Effects of mesh size on density estimates of copepods, cladocerans, and rotifers. Ecological Society of America, Memphis, Tennessee.

Medley, K.A., K.D. Dickerson, and J.E. Havel, 2006. Downstream turnover of zooplankton communities in the Missouri River. North American Benthological Society, Anchorage, Alaska

Havel, J.E., and K.A. Medley, 2006. Zooplankton diversity and density: Missouri River, 2004-2005. EMAP-GRE Working Group, Alton, Illinois

Medley, K.A., and J.E. Havel, 2006. Effects of fish presence, hydroperiod, and flooding on pond zooplankton communities in a reservoir floodplain. Missouri Natural History Conference, Lake of the Ozarks

Chick, J.H., J.E. Havel, J. Jack, K.A. Medley, and A. Levchuk, 2006. Analysis of EMAP Great Rivers Zooplankton Data: Update and Preliminary Results. Environmental Protection Agency, Reference Conditions meeting, Cincinnati, Ohio.

Barnhart, M. C. 2006. Progress in the captive culture and toxicology of freshwater mussels. Society for Environmental Toxicology and Chemistry, Asia Pacific 2006: Growth with a limit, Beijing, China.

Barnhart, M. C. 2006. Progress in the captive culture and toxicology of freshwater mussels. Freshwater Fisheries Research Center, Wuxi, China

Barnhart, M. C. 2006. Progress in the captive culture and toxicology of freshwater mussels. Shanghai Fisheries Institute, Shanghai, China

Barnhart, M. C. 2006. Research on native mussels at Missouri State University. Kansas Mussel Workshop, Missouri State University, July 12.

Barnhart, M. C. 2006. Introduction to native mussels. Missouri Stream Team Workshop, Meramec State Park, July 29-30.

Kaiser, Brianna and Barnhart, Chris. 2006. Effects of hypoxia on brood survival in the freshwater mussel, *Venustaconcha ellipsiformis*. Society for Environmental Toxicology and Chemistry. Columbia, MO. **BEST STUDENT POSTER AWARD.**

Barnhart, M. C. and Ning Wang. 2006. Overview of the toxicology of North American freshwater mussels. Symposium, Emerging Trends in Ecotoxicology. Society of Environmental Toxicology and Chemistry. Columbia, MO 5/22/06 **INVITED PLENARY**

Barnhart, M. C. 2006. What the heck is a Neosho mucket, and why should I care? USDA NRCS Area IV Meeting, Springfield, MO April 27 **INVITED**

Barnhart, M. C. 2006. Methods for the propagation of native freshwater mussels. Biennial Workshop of the Freshwater Mollusk Conservation Society, Columbus Zoo, Columbus OH. **INVITED**

Bowers, J. and M. C. Barnhart. 2006. Competition and interference among the parasitic larvae of freshwater mussels. Poster presentation, Missouri Natural Resources Conference, Lake Ozark, MO.

Kaiser, Brianna, K. and M. C. Barnhart. 2006. Effects of hypoxia on juvenile freshwater mussels. Mollusk Conservation and Management Workshop, Missouri Natural Resources Conference, Lake Ozark, MO. **INVITED**

Fobian, T. and M. C. Barnhart. 2006. Reproductive biology of the rabbitsfoot mussel, *Quadrula cylindrica*, in the Black and Arkansas River systems. Mollusk Conservation and Management Workshop, Missouri Natural Resources Conference, Lake Ozark, MO. **INVITED**

Barnhart, M. C. 2006. Progress in Methods for Culturing Native Freshwater Mussels. Mollusk Conservation and Management Workshop, Missouri Natural Resources Conference, Lake Ozark, MO. **INVITED**

Barnhart, M. C. 2006. Host use and host abuse in the Unionidae. University of Oklahoma, Department of Zoology. **INVITED**

Table 5: OEWRI's Externally-funded Grants for 2004, 2005, and 2006 (total= \$1,255,770)

Principle Investigator(s)	Funding Agency	Title	Source	Date	Award (\$)
<u>2004= \$110,203</u>					
1) Pavlowsky, R	National Park Service	National Park Service-Heartland Network physical habitat assessment protocol	Federal	09/01/03	68,977
2) Pavlowsky, R	EPA/DNR via Watershed Committee of the Ozarks	Valley Water Mill restoration project (319)	Federal	10/01/03	11,726
3) Barnhart, M.C.	U.S. Fish & Wildlife Service	A search for Epioblasma forentina curtisi	Federal	08/13/04	25,000
4) Barnhart, C	U.S. Fish & Wildlife Service	Host Fish Requirements of the Winged Mapleleaf Mussel in the Ouachita and Bourbeuse river Systems	Federal	09/17/04	4,500
<u>2005= \$400,338</u>					
5) Pavlowsky, R; Biagioni, R & Cammack, R	EPA via Upper White River Basin Foundation	Geospatial database and baseline water quality for the Upper White River Basin, MO and AR	Federal	01/12/05	53,893
6) Pavlowsky, B	EPA/DNR via Greene County	Ward Branch channel and water quality monitoring 319 (I)	Federal	01/31/05	16,970
7) Havel, J	EPA/USGS via INHS	Analyses of zooplankton samples from the Missouri River and its mainstream reservoirs	Federal	02/22/05	170,000
8) Barnhart, MC	US ACE	Propagation of the Endangered Freshwater Mussel, Potamilus Capax	Federal	05/19/05	9,468
9) Moskal, LM	MDC	Geovisualization of urban growth in the Brush Creek Watershed	State	07/18/05	9,269
10) Pavlowsky, R	Watershed Committee of the Ozarks	South Dry Sac River channel assessment in the Valley Water Mill area	Non-Profit	07/21/05	9,576
11) Barnhart, MC	US FWS	Host Fish Requirements and genetic Relationships of the Rabbitsfoot Mussel in the Black and Upper Arkansas River Systems	Federal	08/01/05	20,000
12) Cammack, R	Greene County	Geospatial science development of Greene County Planning and Zoning	County	08/03/05	25,356
13) Barnhart, M.C.	U.S. Environmental Protection Agency	Effects of hypoxia on freshwater mussels	Federal	09/12/05	64,985
14) Pavlowsky, R	EPA/DNR via Greene County	Ward Branch channel and water quality monitoring 319 (II)	State	09/14/05	15,275
15) Gouzie, D	Watershed Committee of the Ozarks	Missouri speleological file indexing	Non-profit	12/07/05	5,546

16) Pavlowsky, R	Partnership MSU-USGS	Memo of Understanding between MSU and USGS-MCGSC	Federal	12/13/05	0
<u>2006= \$745,238</u>					
17) Cammack, R	Greene County	Geospatial science development of Greene County Planning and Zoning	County	01/25/06	31,864
18) Pavlowsky, R	U.S. Environmental Protection Agency	Ozarks Environmental and Water Resources Institute at MSU-Phase 1 Start-up Funding	Federal	03/09/06	496,000
19) Rhodes, R	Virginia Department of Game and Inland Fisheries	Assessment of phytoplankton abundance in water supplied for mussel production	State	03/14/06	4,000
20) Pavlowsky, R; Steiert, J; Gouzie, D	James River Basin Partnership	Finley Creek water quality baseline study-Phase 1	Non-profit	03/27/06	6,757
21) Pavlowsky, R	EPA/UWRBF via Bull Shoals Fieldstation	Nutrient analysis for Beaver Creek water quality monitoring	Federal	05/15/06	6,688
22) Pavlowsky, R	EPA/ERC via MEC Water Resources	SW Missouri Water Quality Improvement (GAP)	Federal	09/05/06	108,500
23) Pavlowsky, R	EPA/DNR via James River Basin Partnership	Stormwater runoff in the James River Watershed 319	Federal	09/11/06	69,910
24) Pavlowsky, R	EPA via CRPM/SMCOG	Bennett Spring State Park area: Planning for wastewater treatment and water quality education (404b)	Federal	10/15/06	6,470
25) Pavlowsky, R	EPA/DNR via Greene County	Ward Branch channel and water quality monitoring 319 (III)	Federal	12/19/06	15,049
<u>Denied Proposals</u>					
1) Pavlowsky, R	University of Missouri-Columbia	Improving water quality in the Finley River Watershed - a high priority watershed in southwest Missouri	State	FY 2004	70,000
2) Pavlowsky, R	U.S. Department of Agriculture	Flat Creek USDA 406 monitoring project	Federal	FY 2004	87,461
3) Pavlowsky, R	U.S. Environmental Protection Agency	Finley River urban water quality 310 project	Federal	FY 2004	67,410
4) Evans, K; Mickus, K; Miller, J; Rovey, C	National Science Foundation	Weaubleau-Osceola impact studies (WISP): A multidisciplinary effort to explore a newly discovered impact structure	Federal	FY 2005	572,132

Table 6: OEWRI Research Collaborators

(C indicates some type of formal contract was established between OEWRI and the listed partner)

Groups

Watershed Committee of the Ozarks (C)
James River Basin Partnership (C)
Upper White River Basin Foundation (C)
Table Rock Lake, Inc.
Environmental Resource Coalition (flow through)

Government Agencies

Environmental Protection Agency (C)
Missouri Department of Natural Resources (C)
Missouri Department of Conservation
Greene County, Missouri (C)
City of Springfield, Missouri (C)
National Park Service, Heartland Network (C)
National Resources Conservation Service
Southern Missouri Water Quality Project
USGS-Mid Continent Geographic Science Center (C)
U.S. Fish and Wildlife Service (C)

Universities

University of Missouri-Columbia
Lincoln University
University of Arkansas (C)
East Carolina University (C)

Private

MEC Water Resources (C)
Olsson Associates (C)

Missouri State University

Center for Archaeological Research (C)
Center for Resources Planning and Management (C)
Bull Shoals Field Station (C)

Faculty at MSU

Doug Gouzie, Geology (C)
Xin Miao, Geography
Jun Luo, Geography
Diane May, Planning (C)
Russ Rhodes, Biology (C)
John Havel, Biology (C)
Dan Beckman, Biology
Chris Barnhart, Biology (C)

Paul Durham, Biology (C)
Jack Steiert, Biology (C)
Janice Greene, Biology (C)
Rich Biagioni, Chemistry (C)
Gary Meints, Chemistry
Tom Dewitt, Agriculture/NRCS

Table 7: Awards to Students working on OEWRI Projects from the Department of Geography, Geology, and Planning.

1) Maya Hirsch (Williamson) (GEO): First place, Geomorphology Specialty Group MS “best oral paper” contest. Awarded a \$200 prize at the annual meeting of the Association of American Geographers in Denver, April 2005.

2) Derek Martin (GEO): won one of eight “Best oral paper” awards at MSU’s Graduate Interdisciplinary Forum held on April 23, 2005.

3) Willard Rodgers (GEO): won one of ten “Best poster” awards at MSU’s Graduate Interdisciplinary Forum held on April 23, 2005.

4) Derek Martin (GEO): “Outstanding Research Assistant” award at MSU’s Graduate Interdisciplinary Forum held on April 23, 2005.

5) Tim Davis (NAS): “Best Oral Paper” award at MSU’s Graduate Interdisciplinary Forum held on April 8, 2006.

6) Mark Gossard (GEO): “Best poster” award at MSU’s Graduate Interdisciplinary Forum held on April 8, 2006.

7) Ron Miller (GEO): “Best Oral Paper” award at MSU’s Graduate Interdisciplinary Forum held on April 8, 2006.

Table 8: Public Affairs Presentations by OEWRI

- 2003: Testimony on water quality issues 10/3, Public hearing of the State of Missouri Interim Committee on Water Quality Issues, SMSU Campus.
- 2004: *Geomorphic adjustments of Ozark streams to land use disturbance*, Annual Meeting of the Missouri Association of Professional Soil Scientists, January 28, 2004, Tan-Tar-A Resort, Lake of the Ozarks, Missouri
- 2005: Workshop on *Advances in Ozark Stream Assessment*, Missouri Natural Resource Conference, February 2-4 2005, Tan-Tar-A Resort, Lake of the Ozarks, Missouri
- 2005: *Water Quality Research at Missouri State University*, Environmental Workshop for the Army Research Office and Lincoln University, Ft. Leonard Wood, November 29-30, 2005.
- 2006: *OEWRI: Introduction and Projects*: Rotary Club of Branson/Hollister, Missouri, October 25, Branson.
- 2006: *River and Lake Sediment Contamination Trends in the James River Basin, Missouri: Applications for Nonpoint Source Assessments*, Arkansas Watershed Advisory Group (AWAG) annual conference, November 2006, Fayetteville, AR.
- 2006: *OEWRI: Introduction and Projects*: Water Talk Watershed Group meeting, Dec, Crowder College, MO.