

Research in the Ozarks

The USGS Columbia Environmental Research Center (CERC) is active with several research projects in the Ozark Highlands, a unique ecoregion that reaches into Missouri, Arkansas and Oklahoma. The Ozark Highlands is home to many endemic terrestrial and aquatic species, not only important ecologically, but is a strong economic base for many communities. CERC recognizes this ecoregion as a critical natural resource and works with partners to provide needed information and strategies for the management of this valued area.

CERC Projects:

- Ecological classification of riparian systems, characterization and mapping of vegetation communities, plant population demographics and microhabitat variables in the context of global climate change.
- Determination of potential effects of lead-zinc mining on the biological resources in southern Missouri.
- Development of standardized methods for conducting freshwater mussel toxicity tests, protecting endangered and threatened species.
- Use of passive samplers and toxicity testing to determine water quality in Ozark caves to protect endangered karst species.



Crayfish play an important functional role in detrital leaf processing in Ozark streams. Mining-derived metals were shown to decrease crayfish populations in the Black River system in southeast Missouri.

CERC scientists are evaluating the functional significance of the depauperate crayfish populations by using *in-situ* enclosure/exclosure experiments assessing relative rates of leaf processing in the presence and absence of crayfish. The results will be used to determine the effects of mining-derived metals on critical ecosystem functional processes in streams.

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Scientists at CERC document the management action of prescribed burning in selected Ozark forested areas, and closely follow the recovery of many diverse plants on the forest floor. (Note: these two photos are not before and after, they were taken at different areas).

Relevant CERC Publications

<http://www.cerc.usgs.gov/>

- Accumulation of metals in fish from lead-zinc mining areas of southeastern Missouri, USA *Ecotoxicology and Environmental Safety*, 67(1): 14-30
- Acute toxicity of copper, ammonia, and chlorine to glochidia and juveniles of freshwater mussels (Unionidae) *Environmental Toxicology and Chemistry*, 26(10): 2036-2047
- Advances and opportunities in assessing contaminant sensitivity of freshwater mussel (Unionidae) early life stages *Environmental Toxicology and Chemistry*, 26(10): 2025-2028
- Assessment of elemental concentrations in streams of the New Lead Belt in Southeastern Missouri, 2002-05 U.S. Geological Survey, Scientific Investigations Report 2007-5057
- ASTM E2455-06: Standard guide for conducting laboratory toxicity tests with freshwater mussels *Annual Book of ASTM Standards*, Volume 11.05, West Conshohocken PA
- Bioavailability of lead and cadmium from mine tailings to the pocketbook mussel (*Lampsilis ventricosa*) *Proceedings of the Workshop on Die-Offs of Freshwater Mussels in the United States*, Richard J. Neves, Editor Sponsored by the U.S. Fish and Wildlife Service and the Upper Mississippi River Conservation Committee: 115-142
- Biomarkers of metals exposure in fish from lead-zinc mining areas of Southeastern Missouri, USA *Ecotoxicology and Environmental Safety*, 67(1): 31-47
- Biomonitoring of lead, zinc, and cadmium in streams draining lead-mining and non-mining areas, Southeast Missouri, USA *Environmental Monitoring and Assessment*, 129 (2008): 277-241

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Relevant CERC Publications (cont'd.)

<<http://www.cerc.usgs.gov/>>

- Chronic toxicity of copper and ammonia to juvenile freshwater mussels (Unionidae) *Environmental Toxicology and Chemistry*, 26(10): 2048-2056
- Concentrations of cadmium, cobalt, lead, nickel, and zinc in blood and filets of northern hog sucker (*Hypentelium nigricans*) from streams contaminated by lead-zinc mining: Implications for monitoring *Archives of Environmental Contamination and Toxicology*, 56(3): 509-524
- Concentrations of metals in aquatic invertebrates from the Ozark National Scenic Riverways, Missouri U.S. Geological Survey, Open-File Report 2007-1435
- Differential exposure, duration, and sensitivity of Unionoidean bivalve life stages to environmental contaminants *Journal of the North American Benthological Society*, 27(2): 451-462
- Ecological effects of lead mining on Ozark streams: In-situ toxicity to woodland crayfish (*Orconectes hylas*) *Ecotoxicology and Environmental Safety*, 72(4): 1207-1219
- Ecological impacts of lead mining on Ozark streams: Toxicity of sediment and pore water *Ecotoxicology and Environmental Safety* 72(2): 516-526
- Effect of lead-zinc mining on crayfish in the Black River watershed, Missouri Department of Conservation, Science Notes, 3: 2p.
- Effects of lead-zinc mining on crayfish (*Orconectes hylas*) in the Black River watershed, Missouri *Freshwater Crayfish*, 16: 97-111
- Effects of mining-derived metals on riffle-dwelling benthic fishes in Southeast Missouri, USA *Ecotoxicology and Environmental Safety* (in press)
- An evaluation of freshwater mussel toxicity data in the derivation of water quality guidance and standards for copper *Environmental Toxicology and Chemistry*, 26(10): 2066-2074
- Evaluation of potentially nonlethal sampling methods for monitoring mercury concentrations in smallmouth bass (*Micropterus dolomieu*) *Archives of Environmental Contamination and Toxicology*, 53(1): 84-95
- Exotic plant species associations with horse trails, old roads, and intact native communities in the Missouri Ozarks *Natural Areas Journal*, 29(1): 50-56
- Gravel sediment routing from widespread, low-intensity landscape disturbance, Current River Basin, Missouri *Earth Surface Processes and Landforms*, 24(10): 897-917
- Historical land-use changes and potential effects on stream disturbance in the Ozark Plateaus, Missouri U.S. Geological Survey, Water Supply Paper 2484
- Influence of pH on the acute toxicity of ammonia to juvenile freshwater mussels (Fatmucket, *Lampsilis siliquoidea*) *Environmental Toxicology and Chemistry*, 27(5): 1141-1146
- Intra- and interlaboratory variability in acute toxicity tests with glochidia and juveniles of freshwater mussels (Unionidae) *Environmental Toxicology and Chemistry*, 26(10):2029-2035
- Lead in: Jorgensen, S.E. and B.D. Faith, eds. *Encyclopedia of Ecology*, Volume 3: 2133-2139
- A macroinvertebrate assessment of Ozark streams located in lead-zinc mining areas of the Viburnum Trend in southeastern Missouri, USA *Environmental Monitoring and Assessment* (in press)
- Mapping vegetation communities in Ozark National Scenic Riverways: Final technical report to the National Park Service U.S. Geological Survey, Open File Report 2006-1354
- Mapping vegetation communities using statistical data fusion in the Ozark National Scenic Riverways, Missouri, USA *Photogrammetric Engineering & Remote Sensing*, 74(2): 247-264
- Neosho madtom spawning U.S. Geological Survey, Biological Science Report 2002-0002
- Physical aquatic habitat assessment data, Ozark Plateaus, Missouri and Arkansas U.S. Geological Survey Data Series Report DS-94
- Physical stream habitat dynamics in Lower Bear Creek, Northern Arkansas U.S. Geological Survey, Biological Science Report 2003-0002
- Protocol for monitoring metals in Ozark National Scenic Riverways, Missouri: Version 1.0 U.S. Geological Survey Open-File Report 2008-1269
- Relations among geology, physiogeography, land use and stream habitat conditions in the Buffalo and Current River Systems, Missouri and Arkansas U.S. Geological Survey, Biological Science Report 2001-0005
- Residues of 2,3,7,8-tetrachlorodibenzo-p-dioxin in the Spring River, Missouri *Water, Air and Soil Pollution* 32(1-2): 219-231
- A screening-level assessment of lead, cadmium, and zinc in fish and crayfish from Northeastern Oklahoma, USA *Environmental Geochemistry and Health*, 28(5): 445-471