

Eighteen Years of Natural Infrastructure Research Partnerships through the Center for Restoration of Ecosystems and Watersheds at the University of Oklahoma¹

Robert W. Nairn*, Julie A. LaBar, Nicholas L. Shepherd, Dayton M. Dorman, Juan Arango, Brandon K. Holzbauer-Schweitzer, Zepei Tang, and Robert C. Knox²

Abstract: The University of Oklahoma (OU) Center for Restoration of Ecosystems and Watersheds (CREW)³ grew organically from ongoing research efforts in the School of Civil Engineering and Environmental Science (CEES) in 2004. From the start, mined land and water reclamation dominated CREW's research portfolio, with a concentration on watershed biogeochemistry and ecological engineering. In the context of reclamation and restoration, CREW has evolved to emphasize natural infrastructure and ecosystem services through conservation of natural systems and creation and restoration of human-made systems. Over 70 graduate research assistants, 80 undergraduate researchers, and several faculty, staff, post-doctoral fellows, and visiting scholars have supported CREW research. The CREW approach is holistic and multidisciplinary, using an understanding of watershed and ecosystem biogeochemistry to develop sustainable nature-based solutions to complex environmental challenges. Work is conducted on the watershed- and ecosystem-scale, examining environmental impacts and developing remediation and restoration technologies based on ecological engineering techniques. CREW is a field-oriented research team but provides ample opportunities to couple full-scale applications with replicable laboratory and greenhouse microcosm and/or mesocosm experimentation. CREW research is inherently and unavoidably collaborative; partnerships with multiple state agencies (especially the Oklahoma Department of Environmental Quality), tribal nations, municipalities, non-profit organizations, and university collaborators are critical to success. CREW recently began a second ten-year research agreement with the Grand River Dam Authority (spanning 2009-2029), has long-term (>20 years) collaborations with the Quapaw Nation of Oklahoma and Local Environmental Action Demanded (a non-profit organization) and works closely with several university entities. Five water quality research case studies will be briefly described: an urban stormwater low impact development paired watershed project; an examination of the role of an environmental buffer in indirect potable reuse; several full-scale passive treatment system implementations for ecotoxic metal-contaminated mine waters; a challenging irrigation water treatment project in the developing world; and possibilities for large-scale Engineering With Nature applications (a current U.S. Army Corps of Engineers initiative). Given the inescapable global significance of water quality, quantity, security, availability and supply, CREW's local watershed-scale efforts will be presented in a comprehensive context and global linkages will be demonstrated.

Additional key words: Reclamation science, Engineering with Nature, nature-based solutions, academic programs, student success.

1. Oral paper presented at the National Meeting of the American Society of Reclamation Sciences, Duluth, MN. June 12-16, 2022. Published by ASMR; 1305 Weathervane Dr., Champaign, IL 61821.
2. R.W. Nairn and R.C. Knox, Professors; N.L. Shepherd, D.M. Dorman, Graduate Research Assistants, Center for Restoration of Ecosystems and Watersheds, School of Civil Engineering and Environmental Science, University of Oklahoma, Norman, OK 73019; J. Arango, City of New York City, NY; B.K. Holzbauer-Schweitzer, Linkan Engineering, Golden CO, Z. Tang, North Carolina A&T State University, Greensboro, NC and J.A. LaBar, Centenary University, Hackettstown, NJ.
3. Work reported here was conducted throughout North and South America but managed near 35°12'39" N, 97°26' 32" W.