

2015 Update

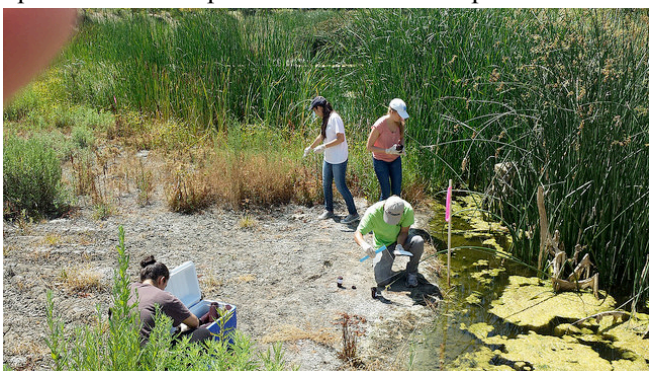
UCI Water PIRE: “Low Energy Options for Making Water from Wastewater”



Overview: Climate change and global population growth demand creative, low-energy, multi-disciplinary, and multi-benefit approaches to sustaining adequate water resources. This NSF-funded Partnerships for International Research and Education (PIRE) catalyzes, through research and education, the development and deployment of low-energy approaches for improving water productivity while protecting human and ecosystem health. The project links five different universities in two water-stressed regions of the world (southwest U.S. and southeast Australia) that have unique and complementary expertise in the development and deployment of rainwater tanks, biofilters, and wastewater recycling for potable substitution and watershed protection. Our Australian partners are world leaders in these topics, as evidenced by the world’s first distributed application of biofilters in an urban catchment (Little Stringybark Creek), a university-industry

Cooperative Research Center on water sensitive urban design valued at \$117M, the world’s largest wastewater stabilization pond, and a world-class facility for visualizing interfacial momentum and mass transport. By facilitating joint research and knowledge sharing, our PIRE accelerates education and training in this critical area of water sustainability, and diffuses knowledge about sustainability options to U.S. middle school and high school students, undergraduate STEM majors, graduate students, post-doctoral researchers, and practitioners.

Research: Research is conducted in four thrust areas: (1) *Improving Pollutant Removal in Biofilters* explores ways of improving the removal of pathogens and micropollutants in storm water runoff by harnessing solar energy and incorporating into biofilter design the plant and animal communities native to local seasonal wetlands; (2) *Public Health Risks, Energy Savings, and GHG Emissions* investigates the risks and benefits of distributed adoption of these technologies on public health, energy consumption, and greenhouse gas emissions; (3) *Regulations, Economic Instruments, Equity, and Policy* identifies social, economic, and policy barriers to the adoption of these technologies, quantifying some of their unpriced benefits and proposing economic instruments, regulations, and public education measures to foster their adoption; and (4) *Watershed Scale Processes* quantifies the impact of distributed adoption of these technologies on urban stream hydrology, water quality, and ecology. Since the UCI Water PIRE was funded by NSF in late 2012 we have submitted or published 22 research articles (with many more under preparation). Many of our articles appear in the very best interdisciplinary and disciplinary journals (*Science, Environmental Science and Technology, Water Research, Geophysical Research Letters, J. Geophysical Research*). This year the UCI Water PIRE team will publish a special issue of the Wiley online journal *WIREs Water* dedicated to our collaborative research with University of Melbourne and Monash University, and we are under contract with Edward Elgar Publishing, Ltd (UK) to write a textbook entitled, *The Water-Sustainable City: Science, Policy, and Practice* (to appear in 2016).



Education and Outreach: Over the past three years the UCI Water PIRE has also orchestrated a number of outreach activities targeting K-12 and undergraduate students. The centerpiece of UCI Water PIRE’s education and workforce development effort is the Undergraduate PIRE Program (UPP) Down Under. “UPP” as we call it is a 6-week summer field-based bootcamp for undergraduates interested in pursuing a Ph.D. in urban water sustainability. It includes a combination of traditional classroom lectures, workshops, field trips, field sampling, laboratory testing, data analysis, scientific writing, and poster and conference presentations. The UPP is truly bi-national: students spend part of their time in Southern California (on the UCI campus) and the rest of their time in Southeast Australia (on the campuses of Melbourne University and Monash University). Students in the first UPP cohort have done extremely well one year after completing the program. Most are in graduate school, and several have received international prizes, including the prestigious NSF Graduate Research Fellowship. The UCI Water PIRE has a number of K-12 programs targeting students from backgrounds traditionally under-represented in STEM fields. Such efforts include:



(1) UCI Water PIRE’s extensive involvement with a local high school that serves a predominantly Hispanic community (The Academy in Santa Ana); (2) outreach to Native American High School Students through participation in the NSF-funded American Indian Summer Institute in Earth System Science (AISIES) at UCI; and (3) 2014 and 2015 Children’s Water Education Festival, where UCI Water PIRE students and staff created “H2Outreach” interactive presentations and games illustrating sustainability research and environmental stewardship for over 700 elementary students. This activity, which was conceived, organized, and run by UCI Water PIRE graduate students, was called out in a 2014 White House press release entitled, “Lifting America’s Game in Climate Education, Literacy, and Training”.