The University of Oklahoma WaTER Center – Water Security Quantity, Quality, Equity

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History of the OU WaTER Center

We in Oklahoma have a long history of dealing with water challenges. The severe drought of the 1930s (the “Dust Bowl”), and the subsequent construction of water impoundments and advances in agriculture practices, are part of our history and culture. We also have experience with water quality issues, ranging from groundwater tainted with naturally occurring arsenic and fluoride to surface water contaminated by historic mining practices. At OU, the Environmental Science degree program began in 1958, with the School of Civil Engineering becoming the School of Civil Engineering and Environmental Science in 1967. In 1979, OU became part of the National Center for Ground Water Research, an EPA Center of Excellence, with the OU Environmental and Ground Water Institute established in 1983. In 2006, in response to the U.N. Millennium Development Goals (MDGs), and in an effort to become more global and holistic in focus, EGWI became the WaTER (Water Technologies for Emerging Regions) Center, which focuses on water and sanitation issues in developing countries, as well as in resource-challenged communities in the U.S. The mission of the WaTER Center (WaTER.ou.edu) is water and sanitation for all, and the vision is the pursuit of improved health, education, development and peace. The WaTER Center strategic plan targets activities in education, outreach and research.

Education – WaTER Minor/Service Learning

Since 2006, we have offered an introductory course on water, sanitation and health (WASH). In 2014, we established an undergraduate minor in “Water and Sanitation for Health and Sustainable Development” (aka, the WaTER Minor), which is open to students from any major. All WaTER Minor students take the introductory course and a hands-on field methods course, and they complete an intercultural immersion experience in a developing country or region. Recognizing that sustainable solutions fall at the nexus of appropriate technology, cultural sensitivity and a viable market-based model, students also take courses in each of these areas. The curriculum helps to prepare students for the Peace Corps, NGOs or graduate level work in sustainable development. Just in its first year, the WaTER Minor already has 20 students enrolled. More recently, the WaTER Center is part of a university-wide program to establish a service-learning course focused on work at St. Monica’s girl’s school in Gulu, Uganda; projects include tutoring students, developing plans for improved drinking water provision, and building lodge huts using plastic bottle construction techniques. The multidisciplinary team will work together while being immersed in a rich African culture that is recovering from the reign of terror of Joseph Kony and the Lord’s Resistance Army.

Outreach – Water Prize/Conference & SWB

One of the first outreach activities of the WaTER Center was the establishment of the OU International Water Prize in 2008. It was inspired by OU’s highly-visible Neustadt International Prize for Literature, which is approaching the Nobel Prize in Literature in importance, with 30 Nobel laureates coming from the Neustadt program over the past 40+ years. Thus, inspired by this success, the OU Water Prize was formulated to “recognize and honor an individual, acting alone or as a leader of an organization, who has made significant contributions, either through
research, teaching or service activities, in the field of water supply and sanitation, particularly for small villages/communities in rural or remote regions.” In talking to Professor R.C. Davis, who administers the Neustadt Prize, it became clear that the prize’s prestige is due largely to the selection process, which we adopted with only minor modifications. Briefly, the WaTER Center Directors choose a panel of five to seven jurors, who themselves are prominent in the field; they are charged with each nominating one candidate for the prize. Jurors are brought to campus for collective deliberations, where a positive elimination process is used, i.e., rounds of dialogue and voting are used to eliminate one nominee at a time so that a consensus can be formed around the winning nominee. The four prize recipients to date have been: 2009 – Dr. Steve Luby, Bangladesh; 2011 – Mr. Ben Fawcett, Australia; 2013 – Ms. Ada Oko-Williams, Burkina-Faso; and 2015 – Mr. Peter Lochery, CARE International/Atlanta.

The Water Prize, which includes a substantive cash award and a custom glass globe in the shape of a water drop, is awarded at our biennial WaTER Conference. The conference brings together people from diverse backgrounds (countries, disciplines, experience) and allows our students to learn from, and interact with, these leaders. Conference sessions include the following: Assessment of WASH Interventions, Groundwater Resources and Well-Drilling Challenges, Fluoride Effects and Mitigation, Capacity-Building, Water Resiliency and Reuse, Gender and Social Equity, Social Entrepreneurship and Market-Based Approaches, Climate Change Impacts and Adaptation. Conference participation has ranged from 170-200 participants from 25-30 countries and 5-6 continents; the next conference will be in September 2017 (WaTER.ou.edu).

Sooners Without Borders (SWB), our successor to EWB, is a service organization on campus that promotes activities and awareness regarding development challenges, such as clean water, sanitation and health. The Group has sent students to New Orleans (hurricane rebuilding projects), Bolivia (passive mine drainage remediation), Guatemala (school construction), and El Salvador (water supply and irrigation). SWB students also plan activities for local K-12 students, including a water walk, water pipe rally to demonstrate hydraulics and a poster contest to increase awareness of water scarcity and the importance of clean water.

WaTER Center Research

The WaTER Center has a growing research portfolio focusing on water quantity, water quality and water equity at scales ranging from the village to the global scale, with WaTER Center faculty conducting research in N. America, S. America, Africa and Asia.

Research – Water Quantity: While the U.S. and Europe are well-instrumented for gathering weather data, this is not true for large portions of the world, especially in developing countries. This missing data is critical for assessing global weather and climate patterns and for predicting the near- to long-term hydrologic impacts of natural and anthropogenic conditions. Remote sensing data (e.g., satellite data) has the exciting potential to help fill data gaps and thereby help develop, calibrate and validate hydrologic models to predict drought or flooding scenarios, both near-term and in the future under climate change scenarios. With support from USAID, NASA, and NSF, faculty and students from the OU WaTER Center and the OU HyDROS Lab (http://hydro.ou.edu) have developed advanced modeling capabilities and training materials for use in capacity building workshops, which have been held in numerous emerging regions, including Namibia, Kenya, Mexico, Pakistan, Nepal, Bhutan, Nigeria, Colombia, and Rwanda. The technologies transferred to governmental agencies and research institutions include the Coupled Routing and Excess Storage (CREST) hydrologic model, the Ensemble Framework for Flash Flood Forecast (EF5) system, and the coupled CREST/landslide model iCRESLIDE.

Research – Water Quality: In the high desert near Potosi, Bolivia, mineral extraction activities have significantly degraded precious water resources. Subsistence farmers (campesinos) irrigate with mine impacted waters containing metal concentrations well above global standards (e.g., arsenic, lead, cadmium, zinc). This leads to elevated ecotoxic concentrations in staple crops (e.g., potatoes) and resultant human health concerns. Faculty and students from the OU WaTER Center, along with partners from the OU Center for Restoration of Ecosystems and Watersheds, St. Francis University (Loretto, PA), Universidad de Autonoma Tomas Frias (Potosi), Engineers in Action, Rotary International and others, have implemented a pilot scale passive treatment system to
address such waters in the Rio Juckucha watershed, Bolivia. A full-scale passive treatment system is currently being planned.

The WaTER Center’s fluoride work in Ethiopia helps to address the needs of an estimated 10-12 million people in the Rift Valley of Ethiopia that are exposed to naturally occurring (geogenic) fluoride at levels that cause dental and skeletal fluorosis. Our work, conducted in collaboration with Addis Ababa University, the Ethiopia Ministry of Water and Energy, and local NGOs (OSHO, CRS), focuses on developing low cost fluoride mitigation systems that are appropriate in the Ethiopian context (using locally available and locally produced materials). This research has led to concepts that are helping local villages while in Ethiopia and that may ultimately be applicable in other developing countries (an estimated 200 million globally), as well as in the United States.

Research – Water Equity: An emerging focus area for WaTER Center research is the equitable allocation of water and sanitation resources within and between populations and ensuring that improvements benefit those most in need. Two examples of this research include a focus on gender equity relative to sanitation, and equitable allocation of scarce water sources between competing demands for human consumption, energy production, and agricultural production. Relative to gender equity, ongoing research is seeking to understand the gender-specific sanitation needs of women in India where only one-third of the population has access to an improved toilet facility. In particular, researchers with OU WaTER Center, along with its research and implementation partners, are examining the social and psychological effects of constrained resource access on women and girls, and then measuring the success of interventions to improve psychological, behavioral, and reproductive outcomes. Understanding these impacts on marginalized women and marginalized communities is an explicit focus area.

Further, beyond human consumption and hygiene, water is also needed for food and energy production. Exploring ways to equitably distribute our precious water resources at this human/energy/food nexus is an area of growing research interest in the WaTER Center, trying to maximize development benefits while minimizing unintended consequences.

Looking ahead

While the WaTER Center was partly established in response to the UN MDGs, we now find ourselves at the threshold of the UN Sustainable Development Goals (SDGs; 2015-2030). Achieving these goals requires transformational changes in how we approach water and WASH to maximize progress while minimizing unintended consequences in pursuit of a water secure world. In the past, lower human population often rendered water relatively abundant, and consequently, water stewardship less critical. Urbanization and climate change have and will continue to exacerbate the water security challenges experienced in isolated cases today. It is thus imperative that we learn from recent pioneering efforts developed for water-stressed environments so that we can anticipate and avoid water-caused instability in the future, on a local and global scale. The WaTER Center seeks to play a leadership role in pursuit of such a water secure future, so that we can live in harmony with one another, and with our planet.

David Sabatini is David Ross Boyd Professor and Sun Oil Company Endowed Chair of Civil Engineering and Environmental Science at University of Oklahoma, where he is Director of the WaTER Center. His current research includes sustainable drinking water systems for developing countries. He is former Editor-in-Chief/current Associate Editor of Journal of Contaminant Hydrology and Editorial Board member, Journal of Water, Sanitation and Hygiene for Development. He has coauthored or coedited four books and over 90 refereed journal publications. His awards include: OU David L. Boren Award for Outstanding Global Engagement (2015), the inaugural Pursuit of Excellence Award, OU Gallogly College of Engineering (2015), Distinguished Alumnus Award, University of Illinois Civil Engineering (2012), Water Environment Federation Merit Award for Work in Developing Countries (2012), and Senior Fulbright Scholar at the Universitaet Tuebingen, Germany (1997/98). He received his BSCE from Illinois, his MSCE from Memphis State and his PhD from Iowa State.

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WaTER Center in El Salvador: Sooners Without Border (SWB) students working on a water project.

WaTER Center in Ethiopia: Teshome Lemma, Jim Chamberlain and David Sabatini, along with local children, in a remote village in the Rift Valley working on point-of-use fluoride treatment.