

Grant Helps USF Students Engineer Solutions Across Borders and at Home

By Brad Stager

For most people living in the United States, accessing basic sanitation is one of the most accessible commodities; turn a handle and away it goes.

Although wastewater infrastructure is critical for protecting human health and the environment, continuous investment in wastewater infrastructure is lagging worldwide. In fact, many



▲ Kevin Orner poses with a family in Panama.

Civil and Environmental Engineering Professor James Mihelcic is the principle investigator for the PIRE grant. He says it provides opportunities for graduate

students to apply their knowledge beyond the college campus and outside of their cultural comfort zone.

“One item related to the NSF PIRE grant is for part of the award, NSF wants us to increase the global competency of early career scientists and engineers. USF PIRE is preparing the engineers to make an impact as leaders at the local and global scale by innovating new technologies, rethinking the concept of “waste”, integrating energy decisions into water management, and training students who can integrate engineered infrastructures with social and environmental systems”.

That global competency includes developing engineering systems and solutions that recovers valuable resources from wastewater that are geographically appropriate and culturally relevant to the communities they serve, and it has been an essential element of the PIRE experience for about 100 USF students pursuing engineering and other degrees, such as anthropology.

Besides working with their peers from other disciplines, USF engineering students also travel to work on integrated water and energy related research and projects with professionals and students from educational institutions in Europe, Latin America and the Caribbean.

The aim is for participants to develop skills and perspectives that will facilitate development of a globally-engaged community of U.S. scientists and engineers who will be able to collaborate with people from other countries and cultures.

A lot of water ends up just going down a drainage system as waste. Laura Rodriguez-Gonzalez is a USF Civil Engineering doctoral candidate who is researching ways to not only minimize adverse environmental impacts of wastewater but to treat it as



▲ Laura Rodriguez-Gonzales works on a lab project in Delft, Netherlands.

U.S. wastewater treatment plants were constructed in the 1970s and 2.4 billion people in the world still do not have access to basic sanitation. In addition, wastewater is increasingly seen as a valuable resource that can provide energy, fertilizer, and fit-for-purpose water. Real-world applications of knowledge and research to keep manage a waste that is now viewed by many as a resource in this country and improving availability of it in others through interdisciplinary research and global partnerships is the impetus behind a \$3.9 million, five-year National Science Foundation grant awarded to USF in 2013.

The Partnerships for International Research and Education (PIRE) grant is part of NSF’s efforts to meet the challenges that a growing global population exerts on natural resources, through engineering and science related educational institutions and their students.

a resource. PIRE provided an opportunity for her to develop her ideas with professionals from other countries. She traveled to the UNESCO-IHE Institute for Water Education in Delft, Netherlands in 2016 to conduct research related to wastewater management. She says that large, centralized systems are not always available or are the best way to go when it comes to managing water resources, including wastewater nutrients.

“My research focuses on advanced decentralized wastewater treatment systems for nutrient mitigation. My hope is to be able to present wastewater treatment alternatives to the traditional centralized systems approach, especially in areas where this approach is not feasible due to geographical and space limitations as well as costs.”

Rodriguez-Gonzalez says as an example, septic waste systems commonly used in the United States could benefit from her research as they can pose risks to the surrounding environment and people living near them if they are not maintained properly. Her research focuses on technology that enhances nitrogen removal in onsite wastewater treatment systems such as those that receive household waste. During her time at UNESCO-IHE she focused on using algae to accomplish that.

Adapting to other cultures and perspectives is an element of PIRE that proved valuable for Rodriguez-Gonzalez, who says the experience informs her research as she moves toward finishing her degree.

“It shows you also how culture shapes people’s thinking and how that impacts the way they use and treat their water. This is particularly important in the development of water and wastewater treatment technologies that are appropriate both geographically and culturally.”

Environmental Engineering PhD candidate Kevin Orner has been involved in projects in Latin America that provide clean water to remote village households and generate energy from animal waste. He says that wastewater contains useful materials that could be utilized if an effort is made to do so.

“Wastewater has resources such as nutrients, energy and water, so there’s quite a few students myself included, who are looking at developing technologies that are able to recover nutrients from wastewater instead of just treating it as a waste that should be discarded.”

With research one thing can lead to another and Reclaim at USF was created to leverage the resources of the PIRE grant along with an EPA grant on nutrient management to promote resource management solutions that are culturally and geographically relevant to the communities being served. Its goals of resource sustainability, interdisciplinary collaboration and relevancy to culture and geography are aligned with PIRE’s values. According to Mihelcic, helping students gain international experience greatly expands their knowledge and can open up further opportunities to them to innovate in U.S. and around the world.

“Laura was able to spend significant time in the Netherlands conducting research at the UNESCO-IHE water laboratory and Kevin had spent significant time in Panama as part of his MS degree at USF,” says Mihelcic. “For his PhD we supported his travel to Costa Rica that ultimately led to him receiving a Fulbright Award to go to Costa Rica next school year.”

While PIRE promotes a global perspective on sustainability, there are also benefits close to home. Orner and Rodriguez-Gonzalez are working with wastewater management officials in Hillsborough County where USF is located to test their ideas about mitigating,

recovering and using wastewater nutrients there.

“Kevin and Laura have both had opportunities to also interact with practitioner organizations in the U.S. so the more sustainable technologies they are developing will be more likely to be adopted by user communities and help the people of Florida and the U.S.,” says Mihelcic.

Graduates supported by USF PIRE have obtained 1) Fulbright scholarships to continue their global engagement (Spain, Costa Rica); 2) prestigious postdoctoral research positions (Yale University, Columbia University, University of Colorado-Boulder, Ecole Polytechnique Federale de Lausanne); 3) science policy positions with the U.S. Environmental Protection Agency and the Centers for Disease Control and Prevention; 4) entrepreneurial positions with technology startups; and 5) faculty positions (University of New Hampshire, University of California-Davis, University of California-Merced, San Diego State University, California State-Chico, Mercer University, Michigan Technological University, and Southern Methodist University).

For more information about PIRE and related projects visit usf-reclaim.org.

Not a Drop of Water to Waste - Laura Rodriguez-Gonzalez

By Brad Stager

A career in environmental engineering seemed like a natural choice to Laura Rodriguez-Gonzalez.



She came to the USF College of Engineering in 2012 to pursue her PhD in Environmental Engineering. Working with Sarina Ergas, professor in the Department of Civil and Environmental Engineering, Rodriguez-Gonzalez’s research emphasizes incorporating biological and physical processes in an innovative technology developed in her laboratory to better manage pollutants impacting our local springs and estuaries that are currently not treated in traditional decentralized household wastewater treatment systems.

“There’s no cookie cutter technology that works for wastewater,” says Rodriguez-Gonzalez. “Decentralized treatment is an option and sometimes might be the only option so we have to advance that.”

She says USF is a good fit for her research interests.

“The Environmental Engineering program is phenomenal. There’s lots of collaboration and opportunity to interact with faculty.”

Rodriguez-Gonzalez says she would like to conduct research and teach after she graduates.

“I liked math and I liked science and I enjoyed the problem-solving part, and I felt like I could apply all these and help people.”

Her home in Salinas, Puerto Rico, on the island’s south coast, provided an opportunity to grow up in an environment characterized by the natural beauty of its Caribbean beaches, lagoons and freshwater wetlands that also demonstrate the value of water as a resource, which is also the focus of her Environmental Engineering PhD research.

“Since I was a kid, I was always in the science club and recycling,” says Rodriguez-Gonzalez, who earned her BS in Civil Engineering and MS in Environmental Engineering at the University of Puerto Rico, Mayaguez.

“When I discovered Civil and Environmental Engineering it was even better. I could apply what I am good at, enjoy doing it, and benefit society by developing technologies that will allow them to have access to sanitation and clean water.”

Engineer Without Borders

By Brad Stager

If you need to know how to say “water” in the Ngäbere language, Environmental Engineering PhD candidate Kevin Orner is a good person to ask.

The 31 year-old grew up in Eden Prairie, Minnesota, far from the lush, tropical regions of Panama and Costa Rica, home to the indigenous Ngäbe, but he has traveled extensively to use his engineering knowledge and skills to benefit people in those two countries and others in Latin America. Much of Orner’s work focuses on potable water supplies in remote areas.

“I believe everyone should have access to clean drinking water and access to sanitation,” he says. “In Latin America, it’s a more rural context and they don’t have similar access to resources like urban areas or in the U.S.”

Working to provide equitable water access began with his experience as a project manager for an Engineers Without Borders wastewater project in El Salvador and continued with the Capstone Design Project for his BS in Civil & Environmental Engineering from the University of Wisconsin-Madison, for which Orner traveled to Ecuador to repair a system that provided water to 4,000 people in a rural community.



Orner decided he wanted to combine his graduate work with helping others.

“I was inspired to continue this work for my Master’s degree,” he says. “It clicked in my head that I could use my engineering skills to meet a real need.”

That path led him to USF’s Master’s International Peace Corps program, which involved a lot of time in Panama to design and build a potable water supply system. Orner received his MS in Environmental Engineering in 2011.

Orner expects to graduate with his PhD in Environmental Engineering in about two years. For his PhD research, he has had the opportunity to work with a nationally recognized group of researchers on developing a novel technology that simultaneously recovers energy and fertilizer components from U.S. wastewaters. But before that, he’s off to Costa Rica for 10 months next year as a U.S. Fulbright Research Fellow to develop ways to turn cow and pig manure into energy and fertilizer, using anaerobic digestion and struvite precipitation.

As for how to say “water” in ngb? Orner says, “Ñö. It sounds like “nyuh.” You can learn more about Orner’s work by visiting his website: kevinorner.com.