SUSTAINABLE SCIENCE

Environmental chemist's research, teaching strive for sustainability by quenching global thirst for clean water, knowledge

BY BILL LOFTUS | PHOTOS BY JOE PALLEN

University of Idaho environmental chemist Greg Möller's lifelong interest in solving environmental challenges globally includes helping students and the public understand the need for sustainability worldwide.

Möller's latest environmental chemistry project — capturing plant nutrients from wastewater — puts a modern twist on sophisticated Mayan farming practices at least 2,000 years old.

Water ranks as one of Möller's most consistent interests during his 25 years on UI's faculty. It is one of life's elemental necessities and presents technological challenges close to home and around the world.

LOCAL PROBLEM CREATES GLOBAL SOLUTION

The challenge began nearly 20 years ago with an intriguing problem: The drinking water in Fruitland, Idaho, contained unacceptable concentrations of arsenic.

Möller and then-graduate student Remy Newcombe set out to devise a new approach to strip the arsenic from the water using rust-coated grains of sand. The test succeeded. Fifteen years later, the Fruitland effort has evolved into a process that effectively removes polluting nutrients from wastewater.

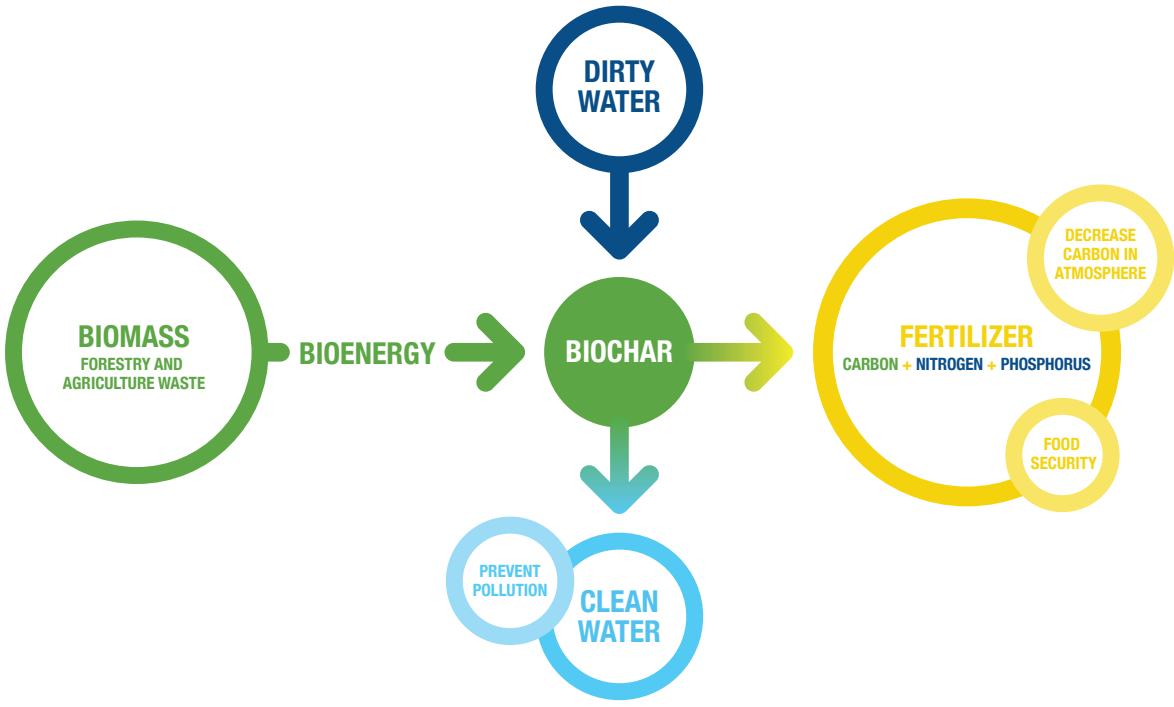
That research has made a difference worldwide: A system of six water treatment plants in South Korea employ the reactive filtration technology in that nation's Four Great Rivers cleanup initiative. A new wastewater treatment plant in Horwich, England — a Manchester suburb — is also piloting the process.

Along the way, Möller's discovery led to six patents issued to UI. All of them are licensed by Blue Water Technologies based in Hayden. Systems have been installed in communities nationwide.

Earlier this year, the council that oversees the Idaho Global Entrepreneurial Mission (IGEM) initiative funded a new Möller project: N-E-W Tech. He believes its ability to remove phosphorus from wastewater and capture it on biochar can help agricultural operations worldwide.

This summer, he put the IGEM funding and a trio of young engineers to work on the Moscow campus. The team is building a pilot-scale N-E-W Tech plant that will work at the nutrient-energy-water nexus to transform conventional wastewater treatment technology.

Biochar is a new word for a substance older than mankind and as familiar as a campfire: charcoal.



Thousands of years ago, Mayan farmworkers added biochar to the soil by regulating fires. Today's farmers still prize the fertility of the "terra preta de indio" (Amazon dark earths) they created.

Agricultural researchers want to find ways to use biochar in modern fields to ensure long-term productivity. Others hope biochar can slow the rapid rise of carbon in the atmosphere by depositing it in the soil in a form that can last for centuries.

Möller's wastewater treatment technology can do both. It inexpensively and efficiently removes nutrients, including nitrogen and phosphorus, from wastewater. It prevents them from fouling lakes and streams with choking algal blooms. By capturing those nutrients on bits of charcoal, farmers can add the nutrients to their fields as fertilizer.

COMMITTED TO EDUCATION

In addition to research, Möller is active in teaching students and the public about the science. His goal is to use the brightly painted 18,000-pound water treatment system loaded on a 40-foot trailer for science show-and-tell to promote sustainability.

The mobile lab can provide field-scale water treatment testing at sites ranging from dairy farm lagoons to city wastewater treatment plants. That mobility can translate into opportunities for school children or dairy operators to better understand an essential technology and the value of water.

Möller has a passion for teaching; he received a Fulbright fellowship to travel to Greece to explore the origins of teaching. In 2014, he was one of two recipients of the USDA National Excellence in College and University Teaching in the Food and Agricultural Sciences Award.

That award in part honored his new approach to online teaching through his "Principles of Sustainability" course (available at www.webpages.uidaho.edu/sustainability/). Möller tapped into an emerging doculecture-style that teaches concepts by showing them in action.

Möller welcomes the public to watch the entire course for free. In five years, the course has drawn more than 500 students from around the country, undergrads and graduate students alike.

"I recognized early that in digital education, I will rarely, if ever, be in the same time zone as my students," Möller said. He is among those pioneering doculectures — documentary-style videos that use media techniques to engage students and deliver information. The People's Weather TV Channel in Africa celebrated June as "Environment Month" and broadcast some of Möller's doculectures across the continent.

The mobile lab offers the ultimate reality show set: real life.

The development of the mobile lab itself is generating international interest. In July, French engineer Pierre Rasson from Suez Environment, a $20 billion-plus French water treatment company with 80,000 employees worldwide, joined the project team as a no-cost industrial intern.

Rasson worked with Martin Baker, a six-year U.S. Air Force veteran and lead systems integration engineer. Baker directs new UI engineering graduates Gene Staggs, himself a 12-year Army vet, and Tim Hammer. Chemistry undergraduate Amber LaVigne and soil science professor Dan Strawn conducted laboratory-based molecular studies that will guide field tests.

"The idea is we'll be able to pull up to a dairy lagoon, conduct our tests and show dairy farmers that this can help them solve water treatment issues, capture nitrogen and phosphorus to grow more crops and generate water clean enough to reuse in their normal operations," Möller said.