AEESP Newsletter

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Highlights

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Please send news, conference announcements, job postings, letters to the editor, and other contributions to the newsletter to Kyle Doudrick at kdoudrick@nd.edu. The next newsletter will appear in June 2022.

President's Letter

BY BILL ARNOLD
University of Minnesota

Seeking Balance

About two years ago, I was having lower back troubles. (You may insert your own joke about getting old here). If I was jostled, sneezed, or slipped on a patch of ice, I would get a shot of back pain as a I regained my footing. I was sure that I had a major back problem that would require surgery. Thankfully, the medical experts figured out that my issue was actually relatively minor. While I was getting exercise, I was neglecting my core muscles, and my pain was caused by using muscles in my back instead of my core. I was given a set of exercises, and they helped immensely.

As my spouse watched me go through my nightly routine, she told me the exercises I was doing were part of the yoga classes she took. Thus, one of our lockdown/pandemic activities became regular yoga sessions using whatever free classes we could find on streaming/online services. I quickly realized the importance of physical balance in yoga. Whether it was the straightforward Tree and Chair poses or the more challenging Warrior Three and Crow poses (see Figure 1 on page 2), I had to focus on staying upright, making adjustments, and of course, getting up when I fell.

As faculty, postdocs, and graduate students, our professional lives are also one of balance. In fact, almost every work day seems like a balancing act. Having research, teaching, and service responsibilities leads to having to balance our efforts between seeking funding opportunities, running research projects, writing (proposals, papers, evaluations, etc.), editing our writing and that of others, meeting with colleagues, meeting with and mentoring students and postdocs, preparing teaching materials, lecturing, running laboratory sections, grading, holding office hours, being an advocate for students, helping students through crises, serving on departmental, college, and university committees of all shapes and sizes, providing career guidance, recruiting new students, serving on professional society committees and boards (including AEESP!), reviewing papers and proposals, engaging with engineering professionals, providing input to policy makers, and any other number of tasks that I haven't mentioned. One of the great things about academia is the opportunity to have impact in so many different ways, but balancing all of these responsibilities, and doing them well, is a challenge.

Among all of this professional juggling, we also have to remember that we need to balance this professional high wire act with our personal lives. It is easy to get so wrapped up in the myriad of tasks that we forget that there are many other ways outside of work to find balance and fulfillment. Getting exercise, partaking in hobbies, helping your community, and spending time with friends and family are the critical components of work-life balance that allow us to take care of our physical and mental health needs. The pressure of academic expectations need to be balanced with our general well-being as individuals.

In these times that have been particularly difficult, we also need to seek balance in our expectations. The impacts of the COVID-19 pandemic – lab shut downs, remote work, disconnections from colleagues and collaborators, limited travel, finding (or being) childcare to name just a few – have made our research and teaching enterprises more challenging. While we can still expect quality work, we have to recognize that a tenure package or graduate thesis may not look exactly the same as it did five years ago. When students finish their degree or when a professional milestone, such as tenure, is reached, the goal should be for the person to be happy both professionally and personally. That is, there should be balance. If someone has sacrificed a beloved hobby, a friendship, or important aspects of family life for their degree or job, the person is unlikely to be content. My hope is that we will be able to look at this issue and offer each other ideas and support as an AEESP community.

I can't say I've always been successful at striking this balance. That said, I don't regret leaving campus early to watch one of my kids participate in a Nordic ski race on a frigid afternoon or baseball game on a sunny day, spending an evening at a

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Figure 1: AEESP President Bill Arnold practicing yoga.

school band or orchestra concert, or consciously ignoring work related tasks (or trying to) on a weekend to bike, hike, or read. Modern technology, especially that smartphone in your pocket, makes it more difficult to separate from work. My goal is to break my habit of letting the urge to check (and respond) to email distract me from being present and focused on non-work life. I'll definitely fall down, but then seek balance again.

You should have recently received a survey from the Membership and Demographics committee about the Global Mentorship Initiative. This has been a highlight of my participation in AEESP, and I encourage you to participate as a mentor or mentee to help each other find this balance. When I first started talking with my two current mentees, I thought I would be the one giving the advice, and while my mentees haven't necessarily offered specific advice to me, hearing about their concerns about balancing commitments and activities has helped me better address my own issues in this regard. Even outside of this specific program, we have a mutual support network within AEESP in which I encourage you to participate.

We also need balance within AEESP as an organization. Specifically, we need to be sure that the variety of voices that are part of our organization are all heard and have opportunities. The strategic planning exercise was the first step. Our monthly Zoom Coffee Hours are another way we are gathering feedback and ideas. I have been especially impressed with the members from far away time zones that have stayed up late or gotten up early to participate! We are also working to ensure that there are more opportunities for people to get involved in AEESP activities by asking that committees have membership that reflects the organization and that there is a clear expectation for each member's length of service.

Thanks for reading, and I hope you are inspired to find some balance. I'm off to work on my Crow pose.

Spotlight: Environmental Engineering Science, AEESP Journal

Mark J. Krzmarzick (Chair of the AEESP Publications Committee), Catherine A. Peters (*EES* Editor-in-Chief), and David A. Ladner (Member of the AEESP Publications Committee),

The "Spotlight" column draws attention to selected articles in *Environmental Engineering Science* (*EES*), the official journal of the Association of Environmental Engineering and Science Professors (AEESP). Spotlight articles appear regularly in the journal as an Editor's Note, as well as in the AEESP Newsletter. Through the publication of high-quality peer-reviewed research, the *EES* journal helps AEESP achieve its mission of developing and disseminating knowledge in environmental engineering and science. In this entry we shine the spotlight on selected articles from the August 2021 through November 2021 issues of *EES*. Congratulations to all whose work is highlighted.

Verma, A., Sharma, L. M., Pahuja, G., Nilling, J. J., Kumar, A., & Singh, A. (2021). Modified biosand filter for provisioning of potable water to rural households affected by chronic arsenic pollution in groundwater. *Environmental Engineering Science,* 38(11), 1036–1051.

Environmental engineers are passionate about improving the lives of people through application of science and engineering; we enjoy studying phenomena in the laboratory, but we also want to see our results implemented for the betterment of communities. An excellent example of this process is reported in Verma et al. (2021). The work focuses on removing arsenic from groundwater in rural India using a filter called "JalKalp." The filter comprises layers of gravel for structural support, sand for filtration and biomass substrate, rusted iron nails for arsenic sorption, and copper material for germicidal benefits. The porosity, retention time, and dispersion properties of the filter were characterized with tracer tests and the properties of the rusted iron nail sorption media were evaluated with scanning electron microscopy and nitrogen gas adsorption for surface area measurement. The filter was effective at both arsenic and pathogen removal in laboratory experiments. This itself is an interesting contribution to the literature, but the team went further. Through the S.M. Sehgal Foundation and other partners they helped communities install the JalKalp filter in 22 locations and measured both the technical and social dimensions of their implementation. The team found that the most challenging task was building trust with a village, but they met that challenge through community meetings and return visits. This work serves as a model for those interested in implementing their science and engineering to realize tangible benefits in people's lives.

Maskwa, R., Gardner, K., & Mo, W. (2021). A Spatial Life Cycle Cost Comparison of Residential Greywater and Rainwater Harvesting Systems. *Environmental Engineering Science*, 38(8), 715–728.

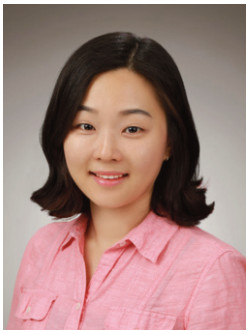
If you've ever opened your water bill on a rainy day, you may have wondered why you pay good money for this commodity that falls from the sky. But if you've built a rainwater harvesting system, you know the complexity and cost are not trivial. Deciding whether the investment makes sense might depend on your location. Maskwa et al. (2021) created a model that helps answer the question: how does location affect the cost and feasibility of rainwater harvesting? They also extended their inquiry into greywater recycling. They ran their model for twelve US cities and found that the amount of rainfall and the cost of water are two key parameters affecting the payback period. For rainwater harvesting, cities such as Tampa, Boston, and Atlanta tend to have the shortest paybacks, since they have more frequent precipitation events and higher potable water fees. Homeowners in cities like San Diego, Salt Lake, and Albuquerque will never see a financial return on their rainwater harvesting investment. For greywater recycling the weather is less important, but the water and sewer fees dominate. With current low fees in many US cities, recycling greywater may not make financial sense, but in cities such as Atlanta and Seattle one might see payback periods of 2 to 3 years. An interesting note from this paper is that for a single-family home the optimal tank volume for rainwater harvesting is on the order of 5 m^3, which is 25 standard-size (200 liter) barrels. The logistics of installing and maintaining all those barrels might help explain why rainwater harvesting is not more widespread. As conditions change over time, the models of Maskwa et al. will aid in discovering the right locations and designs to reap the water-saving benefits of domestic rainwater harvesting and greywater recycling.

Guo, H., & Kim, Y. (2021). Membrane Scaling in Electrodialysis Fed with High-Strength Wastewater. *Environmental Engineering Science*, 38(9), 832–840.

In the ongoing search for ways to recover beneficial products from wastewater, ammonia separation is of great interest. One method to recover ammonia is electrodialysis (ED), which uses an electric field to motivate passage of ammonia through an ion exchange membrane (IEM). Guo and Kim (2021) report their work to understand and alleviate scaling, which is one of the most important hindrances of ED applied to wastewater. They investigated recovery of ammonia from both municipal anaerobic digestate (dewatering centrate after anaerobic digestion) and food waste digestate (the liquid portion after dewatering of anaerobically digested food waste). Characterizing the scalants becomes a lesson in minerology, as the morphologies of struvite and vaterite crystals are observed in scanning electron microscope images along with amorphous calcium carbonate. Struvite precipitation is particularly important to combat, since its needle-like shape can potentially puncture the membrane. The scalant characterization accomplished here will aid in developing pretreatment and/or cleaning techniques for ED reactors, thus helping society progress toward beneficial recovery of ammonia from wastewater.

New Faculty Appointments

Dr. Soyoon Kum Joins Angelo State University



Dr. Soyoon Kum joined the David L. Hirschfeld Department of Engineering at Angelo State University as an assistant professor in May 2021. Dr. Kum received her B.S. degree in Civil Engineering (2010) from Hongik University, M.S. in Civil and Environmental Engineering (2012) from Seoul National University, and Ph.D. in Civil Engineering from the University of Texas at Austin (2019). Her Ph.D. research was about the optimization of NOM removal by a hybrid (ED-NF/RO) membrane system. After her Ph.D., she worked as a postdoctoral research fellow at the University of California, Riverside. She did research on brackish RO brine management by persulfate photolysis, demineralization, and membrane processes. Her research interests are water treatment with membrane technologies and improvement of water security by using alternative water resources. Dr. Kum has been worked globally (the Solomon Islands, Tanzania, Vietnam, and Mexico) to provide appropriate and affordable water quality management solutions for underserved communities. Dr. Kum also has a great interest in water education. She is a co-director for Clean Water Science Network, a 501c3, and works for water education in Latin American countries.

Dr. Kate Newhart Joins the United States Military Academy at West Point

Dr. Kate Newhart joined the Department of Geography and Environmental Engineering at the United States Military Academy at West Point as an assistant professor in June 2021. Prior to her position at West Point, she earned her Ph.D. from the Colorado School of Mines and worked as a Technology & Innovation Engineer for the largest wastewater utility in the Rocky Mountain region. Dr. Newhart's research focuses on applying statistical and machine learning decision-making, monitoring, and control of water resource recovery systems to ensure water, energy, and resource security for future generations."

AEESP Foundation Grant Final Report (1)

Girl Scouts of Maine visit Department of Civil and Environmental Engineering at University of Maine

Report authors: PI: Dr. Onur Apul, Assistant Professor, and Co-PI: Dr. Lauren Ross, Assistant Professor, of Civil and Environmental Engineering at the University of Maine

With the support of AEESP Foundation's Grant Program, the Department of Civil and Environmental Engineering at University of Maine hosted Girl Scouts of Maine during summer of 2021. This project was coordinated by Dr. Onur Apul, Assistant Professor of Civil and Environmental Engineering, his collaborator Dr. Lauren Ross, Assistant Professor of Civil and Environmental Engineering and their graduate and undergraduate students. The goal of the project was to introduce environmental engineering and microplastic pollution to Girl Scouts (Brownie and Daisy Groups accompanied by their troop leaders); because we believe the involvement in an early learning experience positively associates with students' interest in pursuing higher education in STEM fields. The hosting groups involved graduate and undergraduate researchers and they participated in a variety of activities (e.g., Anjali Mulchandani' s Rubik Cube activity to understand the importance of surface area for smaller plastic debris). First, the group took a small campus tour and visited auditoriums, classrooms, labs, and graduate student offices. During the tour, the group was trained by graduate students about microplastic pollution, and they observed the behavior of different microplastics in a wave tank. Next, the group of visitors enjoyed "microplastic hunt" in a blow-up estuary. The estuary is set up by graduate students decorated with LED lights and the microplastic beads were hidden inside to demonstrate how difficult it is to recover microplastics once they are in the environment. The end of the day was crayon drawings about microplastics while enjoying snacks and beverages provided by University of Maine catering services. The students left with hopes to visit again soon and their drawings are currently being displayed at Dr. Apul's Lab.

AEESP Foundation Grant Final Report (2)

Developing educational modules for providing K-12 students with basic principles and engineering concepts behind the design of conventional and new water/wastewater treatment processes

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1. Overview

The goal of the proposed project was to develop educational modules for providing K-12 students with basic principles and engineering concepts behind the design of conventional and new water/wastewater treatment processes. Two faculty developed hands-on experiments for 3 levels of audience (K-5, middle, or high school) to pose two science questions related to their research expertise: "Why can't we use seawater in our daily life? (PI: Kim)" and "How can we remove dirt from water? (Co-PI: Yang)". The learning objectives were to understand how impaired water sources affect our daily water uses, apply engineering solutions to remove undesired compounds, and analyze their working principles using water chemistry fundamentals. Educational staff at Clarkson University, Beacon Institute for Rivers & Estuaries (CU-BIRE) were trained in summer of 2021. Some of the developed educational modules were delivered to students from South Middle School in Newburgh during a field trip to CU-BIRE's Water Ecology Center

Figure 1. Photos of training the two main science questions of the project on "Why can't we use seawater in our daily life" (top) and "How can we remove dirt from water? (bottom).

by the education staff. PI Kim delivered several modules to middle school to high school students during Clarkson University Horizons Program held in summer of 2021. Lastly, a pilot program was delivered to K-5 students at North Country Children's Museum in winter of 2021.

2. Major achievements

2.1. CU-BIRE

PIs Kim and Yang traveled to Beacon, NY to train the education staff at CU-BIRE on June 18, 2021. The training consisted of short presentations to introduce the background by PIs, experiments to demonstrate developed modules for the project, and discussions about the experiments (**Figure 1 on page 6**).

For the first science question ("Why can't we use seawater in our daily life?"), we first introduced the distribution of Earth's water, which was visualized by splitting 1 L of water into saltwater and freshwater (adapted from Water Education Posters available from the USGS website). The freshwater was then divided into 4 containers representing the Earth's total freshwater supply in the form of icecaps, groundwater, surface water, and atmosphere/soil. To effectively demonstrate the impact of ionic compounds typically found in saltwater, two solutions were prepared with and without calcium. A high concentration of calcium is found not only in seawater, but also in groundwater. Because water sources in the state of New York are often hard (i.e., high concentrations in calcium or magnesium), we expected to easily engage students using the actual water source of their home. The experiment was to observe the differences when soap powders were added to soft and hard waters. A jar containing soft water without calcium created more bubbles relative to that containing hard water (**Figure 1, top on page 6**). The soap water chemistry of hydrophobicity and hydrophilicity was also related to handwashing and Coronavirus. One engineering solution to remove contaminants, including Coronavirus, was to use electrochemically generated oxidants.

As the second part of the project ("How can we remove dirt from water?), we demonstrated the use of an electrochemical system to destroy a dye from water (**Figure 1, bottom on page 6**). In the first set of experiments, a IrO^2 anode coupled with a stainless steel cathode was immersed in tap water and water amended with different concentrations of NaCl. 10 V was applied between anode and cathode to observe the current response in tap water (low conductivity) and salt amended electrolyte (high conductivity with high current). The concepts of water conductivity, electrochemical circuit, internal resistance, and overpotential were explained. In the following experiments, the same electrolytic reactor was used to treat water spiked with food dye. Water spiked with NaCl showed the fastest discoloration of food dye due to the production of chlorine via oxidation of chloride reaction. By showing this evidence, the principles of electrochemical oxidation and the concept of reduction potential were elaborated. Furthermore, we introduced the basics of chlorine chemistry (pC-pH diagram, pK_a, and hydrolysis of chlorine gas) and extended the discussion to chlorination and other disinfection technologies.

One of the developed modules on the water distribution was delivered to 100 6th grade students from South Middle School in Newburgh during a field trip to CU-BIRE's Water Ecology Center in the fall of 2021 (**Figure 2**). The demonstration illustrates the low availability of freshwater resources versus salt water on earth. Students then created water filters to be prepared for if they ever need to procure water on their own from a nearby water source. The lesson ended with establishing an action plan for conserving water in their daily lives.

Figure 2. Photograph showing the demonstrating water distribution on the earth to students.

2.2. Clarkson University Horizons Program

As an instructor of Horizons Program held in summer 2021, PI Kim adapted some of the developed modules in his Water Science/Water Purification section (**Figure 3, top**). The total number of participants was 51 in 7th, 8th, and 9th grades (86.3% were female), and these students were from 22 school districts. On day 1, students were engaged with the water distribution and soap bubble experiments mentioned above. On day 2, students made a simple water filtration system using coffee cone/filter and granular activated

Figure 3. Photographs of the classroom at Clarkson University (top), coffee cone filter experiment with its result (bottom left), and water softener experiment with test strip results (bottom right).

carbon, (**Figure 3, bottom left on page 7**) all of which are inexpensive and commonly found in the home. During the activity, students were able to observe how a dye is removed from a colored water and asked to think about why carbons are effective to remove a contaminant by adsorption. The same coffee cone/filter was also used to make an ion exchanger to reduce water hardness. Although a commercial water softener using ion-exchange resins is often installed at homes supplied with hard water sources, students had limited experience with the concept of water softener and its underlying principles are largely misunderstood. Students were engaged in removing water hardness by pouring hard water to the coffee cone/filter filled with ion-exchange resin beads, of which efficacy was confirmed using hardness test strips until the water becomes soft (**Figure 3, bottom right on page 7**). Comprehensive explanations on commercial and industrial processes to reduce water hardness were given followed by the activity, which included a brief introduction to the state-of-the-art technology currently developed in PI Kim's lab.

2.3. North Country Children's Museum

A science program entitled "The Wonders of Water" was piloted at North Country Children's Museum located in Potsdam, NY, on December 11, 2021 (**Figure 4, left**). The goal of this pilot program was to conceptualize size-based membrane separation processes with hands-on experience, which was geared towards K-5 students. In the first activity (**Figure 4, middle**), a sand sieve was used to separate water (sand) from salt (steel balls), representing membrane-based processes including reverse osmosis. In the second activity (**Figure 4, right**), the use of a magnet allowed for removing salt (steel balls) from water (sand), of which concept is similar to an electric-field-driven process using ion-exchange membranes. Approximately 20 kids and adults were engaged in these activities during 60-minute morning and afternoon sessions that were delivered by a science staff and a Clarkson's undergraduate students.

3. Implications and future plans

Although the project was delayed due to the COVID-19 pandemic, we were rather able to engage students by connecting soap chemistry to coronavirus, explaining why washing hands help remove viruses. Electrochemical oxidation would also be an intriguing topic as a means to inactivating viruses. In addition to these, we introduced several water quality standards (e.g., salinity, hardness, and pH) and water treatment processes (e.g., filtration, adsorption, and ion exchange). The most common misconception we identified was about the freshwater distribution. The activity helped not only address the misconception, but also raise the awareness of the limited freshwater resources.

With the experience of piloting several modules in 2021, CU-BIRE will be able to provide enrichment opportunities for students in New York's greater Hudson Valley, including Beacon City school district and 8 other school districts with in-class, field trip, and summer programs. Beacon City school district has a majority of non-white learners, with 57% of students identifying as black/African American, Hispanic, or other minority ethnicity, and 45% of students are economically disadvantaged (NYSED data AY2018-19).

Acknowledgements

This project was supported by the Association of Environmental Engineering and Science Professors (AEESP) Foundation. PIs thank CU-BIRE's education staff (Asher Pacht and Brigette Walsh) for the collaboration. PI Kim thanks Clarkson's Horizons program (director: Melissa Richards) and North Country Children's Museum (science staff: Dan Bellinger; Clarkson's undergraduate: Carolyne Shultes) for their help with piloting several educational modules.

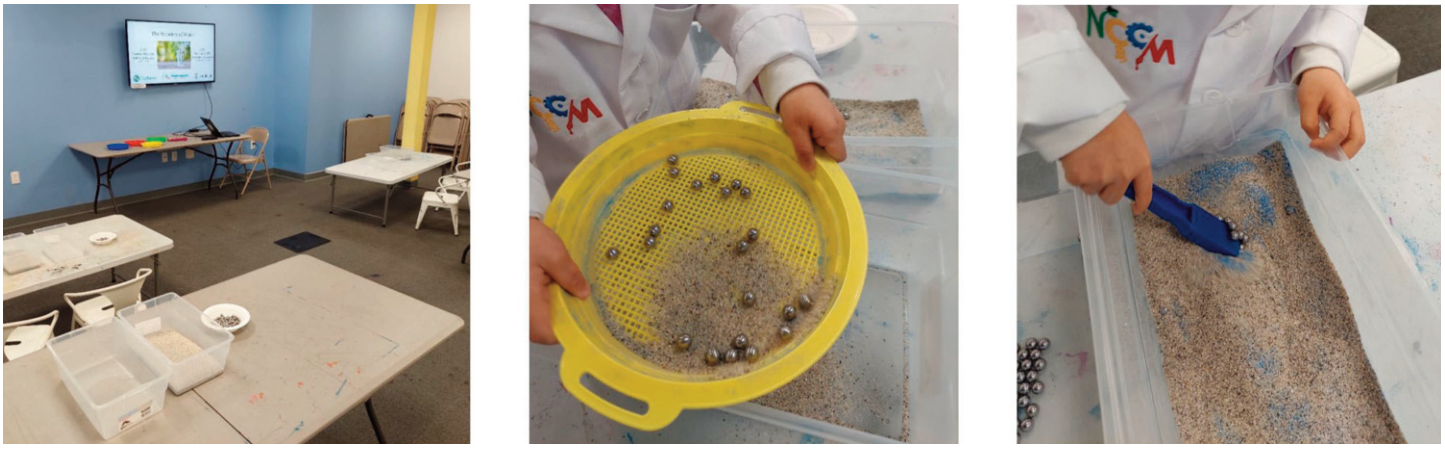


Figure 4. Photographs of the activity room at the North Country Children's museum (left), and activities using a sieve (middle) and a magnet (right).

Memorial Tribute to Ross E. McKinney, Sr. (1926-2021)[1]

With Ross McKinney's passing on September 18, 2021, at the age of 95, the field of environmental engineering and science lost one of its most outstanding leaders. During a career spanning over 40 years, he made numerous major contributions as a teacher, researcher, consultant, and public servant. He was a giant in the field, one on whose shoulders a great many professionals stood to see more clearly while making their own contributions and passing along to their progeny not only the knowledge and research skills they gained under Ross's tutelage, but also his passion for the field and the opportunities it provides to make positive impacts on society.

Ross graduated from high school in Dallas in 1943, then enlisted in the Navy. While stationed at various locations in Texas, he took courses at Southern Methodist University (SMU), Texas Christian University, and Rice University.[2] After his discharge from the Navy he re-enrolled at SMU and completed a BA in math and a BS in civil engineering in 1948. Following a brief stint as a surveyor and consulting engineer, he enrolled at MIT where he earned a master's degree in 1949 and a doctoral degree in 1951, both in sanitary engineering. In 1952 he married Margaret Curtis McKinney, who had recently graduated from Wellesley College; and together they had four wonderful children.

Ross worked at the Southwest Foundation for Research and Education in San Antonio for two years before returning to MIT in 1953 as an Assistant Professor of Civil and Sanitary Engineering. In 1958 he was promoted to Associate Professor, and from 1954-1960 he was also Vice-President of Rolf Eliassen Associates, a professional engineering firm in Winchester, Massachusetts.

At MIT Ross led the way in revolutionizing environmental engineering education. As recently shared by his former student Jim Symons[3], Ross reasoned that "with the characteristics of [wastewater] changing because of … increased manufacturing, … biological treatment of wastewater using handbook designs from the 1940s would not be adequate. Despite his youth, he had this seminal idea [that students should] learn microbiology, chemistry, and biochemistry so biological treatment processes could be designed and operated on a sound scientific basis. Ross [convinced] Full Professors Rolf Eliassen and Clair Sawyer … of the soundness of his plan, and [the] curriculum was revamped. As doctoral graduates [including Perry McCarty and Dick Engelbrecht] took positions at other schools [and implemented this concept, and as their] doctoral graduates repeated the pattern, the concept grew rather like a nuclear chain reaction. Now this is the approach used in all schools, and it all started with an idea that a young Ross McKinney had nearly 70 years ago. Quite an accomplishment."

In 1960, Ross left MIT to head a new environmental health research laboratory at the University of Kansas (KU). At the same time, the State of Kansas decided to move its Chief Sanitary Engineer and his entire staff from Lawrence to Topeka, leaving behind a single part-time faculty member, Howard Stoltenberg. Ross had to develop and staff a new program almost from scratch. He convinced administrators to create a new "environmental health engineering and science" program with M.S. and Ph.D. degrees in both environmental engineering and environmental science. These programs were open to qualified students with an undergraduate degree in any field of engineering or science, respectively. The courses were open to both engineering and science students, who were encouraged to learn from one another and work collaboratively to address complex environmental problems using interdisciplinary approaches.

From 1963 to 1966 Ross chaired what is now the Civil, Environmental, and Architectural Engineering (CEAE) Department at KU. He was named Parker Distinguished Professor in 1966 and N.T. Veatch Distinguished Professor in 1976. He held the latter position until his retirement in 1993, at which time he was granted richly deserved status as Professor Emeritus. In 1997 and for several years thereafter, after he and Margie moved to Raleigh, N.C., he served as an Adjunct Professor in the Civil and Environmental Engineering Department at Duke University.

Ross McKinney's research encompassed a multitude of environmental topics, but he is best known nationally and internationally as a pioneer of new approaches to the design and operation of biological wastewater treatment processes. As he explained: "We start with the fundamentals of microbiology, biochemistry, and engineering, and we tie these together with a design based on the functional needs of the microorganisms that break down the waste products." More than 75 treatment plants were designed based on his research and design recommendations, including plants in Lawrence, KS; Dallas and Austin, TX; Grand Island and Lincoln, NB; and Tulsa, OK.

Ross developed design equations for the completely mixed activated sludge process, which is especially useful for treating industrial wastewaters varying in flow and composition. He consulted with many industries regarding wastewater treatment, including pulp and paper, food processing, meat-packing, petroleum refining, and cotton, wool and synthetic textiles. One of the world's largest operating anaerobic industrial wastewater treatment plants, located in Puerto Rico, was designed based largely on his concepts; and it produced enough methane to power the entire enterprise. He noted that: "A biological system that produces methane represents a sure way to have a

continuous source of energy," one that may be particularly important and useful for underdeveloped nations because it is inexpensive.

Ross also worked on numerous pollution control projects with consulting engineering firms and federal, state and local governments. He published over 200 technical papers, over 60 research reports and over 370 consulting reports. He was an outstanding educator for more than 40 years, supervising the theses of over 160 graduate students, and inspiring hundreds more in the classroom. "I learned a long time ago," McKinney once said, "that if you are to be successful, you have to educate the people who will do the work. You train your army to go out and win the battles. We never lose sight of our students and they never lose sight of us." Because of his reputation, he was the first environmental engineer invited to China after the Cultural Revolution to lecture on solving environmental pollution problems, and he made five lecture trips to China between 1979 and 1989.

For his contributions to environmental engineering through teaching, research, and consulting, Ross McKinney received numerous honors and awards, including the Water Pollution Control Federation's 1962 Harrison Prescott Eddy award; ASCE's 1964 Rudolph Hering Medal; election as an ASCE Fellow (1968); WPCF's 1982 Thomas R. Camp Medal; the KU Chancellor's Club 1986 Career Teaching Award; WPCF's 1991 Gordon Maskew Fair Medal; and the KU School of Engineering's 2016 Distinguished Engineering Service Award. He was listed in the 125th Anniversary Edition of *Engineering News Record* (Aug. 30, 1999) as one of the top 125 engineers in the last 125 years. In 1977 he was elected to the National Academy of Engineering (NAE), the highest professional distinction that can be conferred on an engineer. In 1981 he was elected as a Fellow of the American Association for the Advancement of Science.

In 2020, the Ross E. McKinney Professorship was established at KU in his honor. His family and colleagues suggest that people wishing to honor Ross's memory consider donating to this professorship. Gifts can be made online or by mail (Attn.: Gift Processing, KU Endowment, P.O. Box 928, Lawrence, KS 66044-9950) by designating the Ross E. McKinney Professorship as the purpose of the gift. Additional information (with photos) about Ross and his family is available in his obituary and in a detailed profile[2] in the October 1993 issue of *Environmental Engineer*. A tribute by one of Ross's former students, Cindy Wallis-Lage, is expected to appear soon on the NAE website.

[1]Submitted by Steve Randtke, Professor Emeritus, on behalf of the CEAE Dept., Univ. of Kansas. Based in large part on an anonymous profile posted on the CEAE website in 1999 and a 1992 copy of Ross McKinney's c.v.

[2]Anderson, W.C., "Ross E. McKinney, Ph.D., P.E., DEE, Mr. Activated Sludge," *Environmental Engineer*, Vol. 29, No. 4, October 1993.

[3]Jim Symons, in Ross McKinney's Obituary, *The News & Observer*, Chapel Hill, NC, Aug., 26, 2021.

Curbing Climate Change the Natural Way

William J. Cooper, Professor Emeritus, UC Irvine (email: wcooper@uci.edu)
President, Pierella Rainforest Reclamation Project (PRFRP)

Scarlett Macaw

If nothing else, COP 26 showed that we are far from seriously curbing emissions from burning fossil fuels. To achieve the goal of lowering the largest greenhouse gas, CO_2, in the atmosphere, the environmental engineering and sciences community has many potential solutions to offer. In my view, we must pursue all alternatives.

In retirement, I founded and recruited a team to form an NGO, 501(c)3, Pierella Rainforest Reclamation Project (PRFRP). Our focus is removing CO_2 from the atmosphere by carbon capture and sequestration, using natural processes, trees.

Blue-Jeans Poison Dart Frog

White-Collared Manakin

Mother Nature has been working with land plants since the beginning of the Devonian Period which is approximately 419 million years ago. From very simple to much more complex plants, we arrive at the present day, where photosynthesis converts CO_2 to organic molecules, sugars. Our Mother Earth took eons to get this photosynthetic engine fine-tuned. That is why we refer to the Amazon as the lungs of the planet, inhaling CO_2 and exhaling oxygen (O_2).

Interestingly, the overall efficiency of photosynthesis using solar radiation is calculated at a theoretical efficiency of approximately 11%. Photosynthesis, using photosynthetically active radiation, 400 – 700 nm is the energy source and when considered globally is responsible for about 50% of the atmospheric oxygen we breathe.

Fundraising is PRFRP's main goal to purchase property (initially focusing on pastures) to convert land to secondary growth rainforests in Costa Rica. Because rainforests are the densest forests, they can capture more carbon per unit area than other ecosystems.

The benefits of reforestation, in addition to tackling climate change, are increasing biodiversity, enhancing ecosystem services and creating wildlife corridors, which in total help to achieve sustainability.

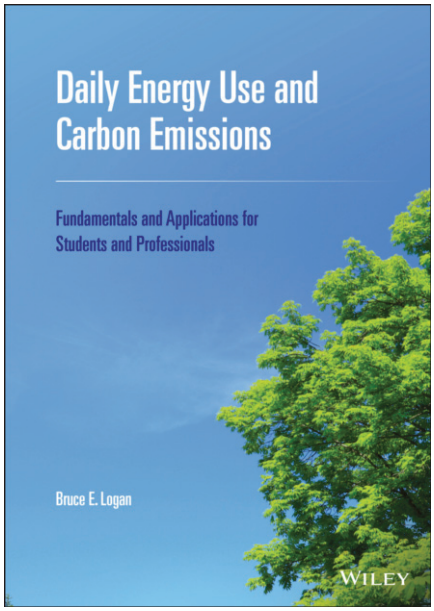
A critical synergistic aspect of PRFRP is education. Eventually, we hope to offer scholarships/internships to study with us in Costa Rica. We already have two graduate students from the University of Michigan and an undergraduate from Wayne State University working with us. Our local student from Costa Rica and I have recently published a paper entitled "Carbon Storage Estimation in a Secondary Tropical Forest at CIEE Sustainability Center, Monteverde, Costa Rica," *Scientific Reports* 2021.

The incremental nature to expanding our mission is only limited by our availability of funds to purchase land. For me, the "butterfly effect" is the most exciting aspect of our NGO. If you want to be part of our solution to climate change, learn more about Pierella Rainforest Reclamation Project, or donate, you can contact me (wcooper@uci.edu). Visit our website, **www.PRFRP.org**.

Daily Energy Use and Carbon Emissions

by Bruce E. Logan, AEESP Fellow

This new book published by Wiley addresses energy and water use and carbon emissions from the perspective of individual consumption against a background of national and global averages. The idea behind the approach used by Logan is that reducing fossil fuel consumption, carbon emissions, and other greenhouse gases can be more effectively facilitated through a better understanding of how much energy we use if it is expressed in easy-to-understand terms, and without the need for large units that can make the information difficult to relate to in our daily lives. Thus, energy use is normalized to food energy for one day, called a daily energy unit D, carbon emissions are normalized to that carbon dioxide released from eating that food (1 C), and water use is expressed relative to that which we need to live (1 w). Once these numbers are normalized to these baselines it is easy to relate your own activities to national averages and see how your lifestyle contributes to climate change. For example, how much energy is used for your home compared to your car? How do carbon dioxide emissions compare from one overseas trip to a year of driving to work?



Environmental Engineers can use this book as the sole textbook for a course on energy use and climate change, or as a supplement to other courses. There are numerous examples, written out clearly with appropriate units, that show how we can calculate energy in gasoline versus our food, how much primary energy is used to produce electricity in the US, and how carbon emissions differ from electric vehicles due to the power plants used to produce that electricity compared to gasoline used by an internal combustion engine vehicle. This book will prepare the next workforce of engineers, scientists, and others to understand the challenges of modifying our energy and industrial infrastructure and help them to infuse low-carbon energy solutions into different engineered systems.

The book can be used at virtually any undergraduate level, for example in a freshman seminar or a junior-level course focusing on energy, climate and sustainability related to the engineered infrastructure. Lectures, exams, book figures, and other course-related materials are available from the author and will soon be uploaded to the Wiley site.

The book is now available electronically using **ISBN: 978-1-119-83102-0**. Paper copies will be available in mid-February. The cost of the printed book is $89.95, and it is printed in color.

Calling professors of Historically Black Colleges & Universities (HBCUs)

The American Water Works Association (AWWA) is starting an all-new pilot program for a collective virtual HBCU Student Chapter and would like to ask you for your help.

Students at HBCUs represent a wealth of talent and vitality, and they would greatly benefit the water sector. Students considering a career in water can utilize the American Water Works Association's HBCU Virtual Student Chapter to help them explore this option, with special access to professional learning opportunities, networking, industry research, scholarships, and events.

If you are a professor of an HBCU, we are asking you to help us spread the word about this new opportunity to your students, and we are also inviting you to become a faculty advocate if you are interested in becoming involved.

To learn more about this student chapter, visit the site at https://www.awwa.org/HBCU. For inquiries and to express your interest to join, please Contact Mary Svoboda, AWWA's Sr. Specialist, Membership Programs - msvoboda@awwa.org

Special Collection Call for Papers

"Recovering Resources from Wastewater"

Journal of Environmental Engineering
EE Special Collection Resources (ascelibrary.org)

Submission deadline: July 2022

Aims and Scope

Traditional municipal wastewater treatment consumes less energy than can be theoretically extracted from the carbon within the wastewater. The water and nutrients are also valuable resources that can be recovered for beneficial reuse. Recovering these resources is of increased interest to reduce greenhouse gas emissions and reuse scarce resources. However, recovering resources from wastewater requires careful analyses to avoid unintended consequences such as increasing energy use and greenhouse gas emissions beyond that released by traditional wastewater treatment methods. Modern analyses tools such as technical-economic and life cycle analyses are essential to encourage a paradigm shift from wastewater treatment to water resource recovery. This special issue seeks reviews, research papers, and case studies on recovering resources from wastewater with an emphasis on careful analyses to demonstrate overall positive impacts.

The proposed Special Collection will include contributions that represent all aspects of recovering resources from wastewater with an emphasis on holistic system analyses. Topics include, but are not limited to, the following.

- Review of wastewater to resource technologies.
- Novel, holistic analyses techniques to evaluate and compare technologies to convert wastewater to resources, with an emphasis on discovering unintended consequences.
- Research results and analyses on novel systems to covert wastewater to resources, including energy, nutrients, and other high value products.
- Research results and analyses on novel units to convert wastewater to resources, including energy, nutrients, and other high value products.
- Case studies on the implementation of wastewater to resources that include a holistic costs/benefits analysis.

Manuscript Submission Guidelines

1. Please submit your manuscript via *ASCE Journal of Environmental Engineering* website: **http://www.editorialmanager.com/jrneeeng**.
2. Once on the Editorial Manager website, please indicate that your paper is for the special collection "Recovering Resources from Wastewaters" edited by Steven Safferman, Céline Vaneeckhaute, John Norton, and Xavier Fonoll Almansa.
3. Detailed information on the submission process is provided in the document "Publishing in ASCE Journals: A Guide for Authors" available at **https://doi.org/10.1061/**

Please note that all accepted papers submitted in response to this Call for Papers will be published in regular issues of the *ASCE Journal of Environmental Engineering*, and assembled online on a page dedicated to this Special Collection. See **https://ascelibrary.org/page/joeedu/specialcollections** for the list of Special Collections already published.

Guest editors

- Dr. Steven Safferman, Associate Professor, Department of Biosystems and Agricultural Engineering, Michigan State University, USA
- Dr. Céline Vaneeckhaute, Assistant Professor, Department of Chemical Engineering, Laval University, Canada,
- Dr. John W. Norton, Jr., Director of Energy, Research, & Innovation, Great Lakes Water Authority, USA
- Dr. Xavier Fonoll Almansa, Management Professional Research & Innovation, Great Lakes Water Authority, USA

STEPS
Science and Technologies for Phosphorus Sustainability

Taking STEPS to Advance Phosphorus Sustainability

Submitted by Treavor Boyer, Arizona State University

To address the complex ecological, economic, and sociopolitical challenges predicated by the rapidly expanding use of mined phosphorus in agriculture, the National Science Foundation has announced the creation of a major research center.

The Science and Technologies for Phosphorus Sustainability Center, or STEPS Center, brings together an interdisciplinary team of experts to pursue a "25-in-25" vision. The team seeks to reduce human dependence on mined phosphorus by 25% and also to reduce current losses of phosphorus to soil and water resources by 25% within the next 25 years.

"Phosphorus is used in a very linear system right now. There's no recycling," says Jacob Jones, a distinguished professor of materials science and engineering at North Carolina State University and the director of the STEPS Center. "So, our goal is to enable and encourage the recovery and reuse of phosphorus. We want to increase the circularity of phosphorus flows in the US and globally."

Funded by an initial five-year, $25-million grant and headquartered at North Carolina State University, the STEPS Center involves faculty, staff, and students from eight other partner institutions across the country, including Arizona State University, North Carolina State University, and Marquette University. AEESP members active in STEPS include: Treavor Boyer (ASU), Doug Call (NC State), Detlef Knappe (NC State), Brooke Mayer (Marquette), Rebecca Muenich (ASU), Bruce Rittmann (ASU), and Paul Westerhoff (ASU).

STEPS is recruiting a diverse group of graduate students across nearly 15 different disciplines to advance convergence science that achieves our vision. Please visit the STEPS website for more information, **https://steps-center.org/**.

AEESP Membership

Membership in AEESP offers important benefits to educators, researchers, students, professionals, corporations and organizations engaged in the environmental engineering and science profession. All who are eligible for membership are welcome to join the Association and to participate in the full range of benefits and opportunities. Membership categories and fees are described below, with complete definitions provided in the AEESP Bylaws. Applying online is easy! We welcome your participation!

Regular and Student Membership

Regular Membership in AEESP is open to persons of full-time faculty or instructional rank (instructors, lecturers, assistant, associate, full professors) in environmental engineering or environmental science at academic institutions that offer baccalaureate, diploma, or graduate degrees in environmental engineering, environmental science or related fields.

Rank	Annual Fee*
Full Professors	$110
Associate Professors	$ 85
Assistant Professors	$ 55
Students and Post-docs	$ 15

Members residing in low and middle income countries as identified by the World Bank may request a discount by contacting the Business Office.

Applying for Regular membership is made by submitting a completed application form and a brief two page curriculum vitae online with payment. Alternatively, application materials may be mailed to the Business Office with a check enclosed.

Affiliate Membership

Affiliate Membership is open to individuals who are not eligible for regular membership including:

- Individuals primarily employed outside academia who also hold academic appointments in an environmental engineering or related academic program (e.g. adjunct faculty).
- Individuals primarily employed outside academia who have made contributions to education in environmental engineering or related fields.
- Educators in environmental engineering or related fields who are employed at junior colleges or other educational institutions that do not offer the degrees specified above.
- Individuals who were members at one time and who have retired from active teaching.

Application for Affiliate membership is the same as for regular membership. The annual dues for Affiliate members are $65.

Sustaining Membership

Sustaining Membership is open to individuals and organizations whose concern for education in environmental engineering and related fields stimulates them to assist in strengthening university programs devoted to this area. Sustaining members are often those who employ or interact closely with graduates of environmental engineering and science programs such as consultants, utilities, research foundations, professional organizations, publishers and equipment manufacturers. The financial support provided by Sustaining Members allows AEESP to carry out a variety of special programs that benefit all members of the profession. Sustaining Members have access to all AEESP publications and are invited to all AEESP events. Organizations or individuals desiring more information on Sustaining Membership should write to the Secretary, the President, or the Business Office.

Annual dues for Sustaining Members are $500. Organizations or individuals desiring more information on Sustaining Membership should contact the Business Office at the phone number below.

Ready to join? You can apply for membership online!

https://aeesp.org/user/register

More information can also be obtained from the AEESP Business Office:

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