



**PennState**

# AGRICULTURAL AND BIOLOGICAL ENGINEERING

*“Food, Energy, and Water for 11 Billion People by the End of the 21st Century: How Will We Do it?”*

There is an urgent need to develop innovative, sustainable strategies to provide food, energy, and water for our burgeoning human population. The ubiquitous and highly prolific aquatic plant, duckweed (Lemnoideae), hyperaccumulates nutrients from its environment, simultaneously cleaning water and synthesizing either starch- or protein-rich biomass that can be harvested for a range of applications, including: simple biofuels; advanced chemicals; fertilizers; fodder for meat and dairy animals; and human food. To fully realize the potential of this ecological approach and bring it to market, collaboration across a myriad of technical, economic, and social disciplines is critical. This presentation will highlight some of our research with duckweed across multiple scales in this area: from laboratory microcosms; to bench-scale bioreactors; to pilot-scale field demonstrations and social science experiments.

Our vision for future work will also be discussed.

**Presented By  
Rachel Brennan, Ph.D., P.E.**

**Civil & Environmental Engineering, Penn State**

Dr. Brennan is an Associate Professor Of Environmental Engineering at Penn State University and a Senior Consultant with Golder Associates. She earned a B.S. in Geological Engineering from New Mexico State University, and an M.S. and Ph.D. in Environmental Engineering from the University of Illinois at Urbana-Champaign. Dr. Brennan's expertise is the development and application of enhanced bioremediation technologies for treating contaminated soil and water. In 2007, she was awarded an NSF Faculty Early Career Development (CAREER) Award for her research on the treatment of acid mine drainage using multifunctional substrates. Her current research efforts focus on the biocatalysis of trace organic contaminants, ecological wastewater treatment, and the beneficial reuse of aquatic plant biomass for sustainable fertilizer, fodder, and biofuel production. In addition to an active research program, Dr. Brennan has been recognized with the Outstanding and Premier Teaching Awards by the Penn State Engineering Alumni Society. She currently serves as the Director of Penn State's Advanced Ecological Engineering Systems Lab (or Eco-Machine<sup>tm</sup>) and is a Faculty Advisor to the Penn State Chapter of Engineers Without Borders.



**Friday, November 10, 2017  
2:30-3:30 PM  
304 FOREST RESOURCES LAB**