



**Presented By:**  
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# Environmental Engineering *Seminar Series*

*Friday, February 5th 2016*  
**MDEA**  
**1:30PM - 2:30PM**

## Estimating The Environmental Impacts Of New Technologies Through Future Scenario Development

Estimating environmental impacts of a system at an early design stage provides insights into the overall impact of a new technology and offers the greatest opportunities for improvement. Unfortunately, products at an early stage of development lack sufficient data to perform a traditional life cycle assessment (LCA). There has been significant research on the diffusion of innovations to understand potential market penetration of a new technology, adopter characteristics, and displacement effects. Diffusion of innovation concepts can be useful when constructing scenarios to evaluate the environmental impacts of new products. This research presents methods to construct future scenarios within the context of consequential LCA to identify preferable options for technology design or policy development. The consequential approach is often necessary for emerging systems since a new technology displacing a technology with poor environmental performance has different effects on the system than if it displaces an environmentally beneficial technology. This work uses statistical methods to create possible future scenarios and evaluate the resulting environmental impacts. With similarities to agent-based modeling, the method uses adoption probabilities to simulate technology adoption over time, and the resulting environmental impact of different adoption scenarios. This method is applied to a bioenergy case study, showing how switchgrass may have fundamentally different life cycle results depending on who chooses to adopt switchgrass and where it is grown.



Dr. Shelie Miller is an Associate Professor in the School of Natural Resources and Environment at the University of Michigan, with a joint appointment in the Department of Civil and Environmental Engineering. Dr. Miller holds a Ph.D. in Civil and Materials Engineering from the University of Illinois at Chicago. Her research identifies potential unintended environmental consequences of emerging technologies and finds possible design or policy interventions that will lead to sustainable outcomes. Her research group uses life cycle assessment (LCA) and scenario modeling tools to analyze a variety of systems, including bioenergy, the food-energy-water nexus, hydraulic fracturing, and new vehicle technologies. Dr. Miller was awarded a Presidential Early Career Award in Science and Engineering (PECASE) in 2009 and was recognized as a Kavli Frontiers Fellow by the National Academy of Sciences in 2013. Beginning in Fall 2016, she will serve as a National Academies Jefferson Science Fellow for the US Department of State, where she will spend a year providing scientific expertise to help guide policy decisions.