UCI Samueli School of Engineering | Department of Civil and Environmental Engineering

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Seminar Series

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McDonnell Douglas Engineering Auditorium (MDEA)
1:30PM to 2:30PM

Sustainable Nutrient Management in Agricultural Production: Integrating Social & Ecological Perspectives

Human alteration of the global nutrient cycle by agricultural activities has provided nutritious food to society, but also poses increasing threats to human and ecosystem health through unintended pollution. Managing nutrient more efficiently in crop production is critical for addressing both food security and environmental challenges. Technologies and management practices have been developed to increase the uptake of applied nitrogen by crops. However, nitrogen use efficiency (NUE, yield per unit nitrogen input) is also affected by social and economic factors. For example, to maximize profit, farmers may change crop choice or their nitrogen application rate, both of which lead to a change in NUE. To evaluate such impacts, we use both theoretical and empirical approaches on micro (farm) and macro (national) scales: 1) We developed a bio-economic model (NUE3) on a farm scale to investigate how market signals (e.g. fertilizer and crop prices), government policies, and nitrogen-efficient technologies affect NUE. 2) We constructed a database of the nitrogen budget in crop production for major crops and major crop producing countries from 1961 to 2010. Using this database, we investigated historical trends of NUE and its relationship to agronomic, economic, social, and policy factors. Finally, we estimated examples of NUE and yield targets by geographic region and crop type required to meet global food demand and environmental stewardship goals in 2050. Overall, our research suggests that it is critical to include social and economic processes when studying perturbations of the global nutrient cycle and crafting environmental and food security policy. Better collaboration across disciplines is essential to improve nutrient management in the anthropocene. Ongoing efforts on developing a "Sustainable Agriculture Matrix" have been trying to engage such collaboration.

Xin Zhang is currently working as an Assistant Professor at the University of Maryland Center for Environmental Science (UMCES). The goal of Xin's current research is to evaluate how socioeconomic and biogeochemical processes affect the global nutrient cycle and, in turn, provide policy input on mitigating nutrient pollution while meeting global food and biofuel demands. Xin's research approaches are from both natural science, including the Earth System Model and atmospheric measurements, and social science, such as econometrics analysis. Collaborating closely with economists, modelers, and field experimentalists from US (e.g., Geophysical Fluid Dynamics Laboratory), France (e.g., CIRED laboratory), and China (e.g., China Agricultural University), Xin has published papers on various peer-reviewed journals, including *Nature* and *Proceedings of the National Academy of Sciences*, and have received research grants from multiple institutions, including *National Science Foundation* and *OCP Research LLC*. Xin received a Ph.D. from Yale University (2013), and did postdoctoral research at Princeton University before joining UMCES. In addition to the academic education, she has completed internships and projects at various national and international organizations, including the United Nations.