

**AAP African Futures Program Faculty Mentor Proposal**  
**Modeling the Water-Energy-Food Nexus in Sub-Saharan Africa**  
Laura Schmitt Olabisi, Department of Community Sustainability

Sub-Saharan Africa will be challenged in the coming century to satisfy a growing and urbanizing population's demand for land, food, and biofuels while preserving the quality of the continent's natural resources and developing climate resilience. There is a growing understanding that water, energy and food (WEF) systems are highly interdependent, and scholarship in the WEF nexus has grown in recent years<sup>1</sup>. Nevertheless, policy and management decisions in these systems are typically made in isolation with little understanding of tradeoffs, spillover effects, and unintended consequences of those decisions. This is particularly the case in Africa, where data and information about WEF systems function may be sparse, and decision-makers often lack the resources and capacity to analyze problems through a systems lens. A WEF nexus approach typically requires tools for integrative modelling of trade-offs across sectors with the objective of advancing synergies of WEF interactions. Such a systems approach could minimize the risk within each system while also reducing the transfer of challenges from one sector to another. There are a variety of systems tools which can serve this purpose, including causal loop diagramming, fuzzy cognitive mapping, system dynamics modeling, integrative modeling, and scenario analysis, all of which I have used in my research (see C.V.).

Should I be chosen as a mentor, the early career researcher who works with me would develop a specific WEF research question based on their region and topic of interest. We would then explore that question together using some of the systems analysis methods described above. Examples of questions might be: (1) How might we make food systems in Northern Nigeria more resilient in light of rapid urbanization and climate change? Or (2) What implications do changing cropping patterns and diets in Tanzania have for the country's water use?. Once matched with a mentee, I will work closely with them to develop a research question that is scientifically interesting to both of us and of reasonable scope for a year-long project.

The year's activities would begin with a background literature review and search for available 'off the shelf' modeling tools in the region/system of interest. I would then work with the mentee to conduct a systems analysis of the WEF nexus question in the region of their choosing using systems modeling methods such as causal loop diagramming, fuzzy cognitive mapping, and system dynamics modeling (the mentorship year would include training in these methods). My research group is currently using these methods to analyze the food system in Flint, Michigan, through a Foundation for Food and Agriculture Research grant. In addition, I am a member of the ARISEE platform convened by Dr. Sieg Snapp, and recently submitted a proposal to the NSF AccelNet program for a 'network of networks' focused on synthesizing information on the WEF nexus in Africa, working with Pennsylvania State University, the Stockholm Environment Institute, and the WEF nexus in Africa initiative ([wefnexus.org](http://wefnexus.org)). The mentee would therefore have copious access to both content-area expertise and methodological expertise to address their research question, through my networks. I anticipate at least 2 peer reviewed journal articles coming out of this work, and an external grant proposal, as well as materials targeted towards policy-makers in the mentee's region of interest. Moreover, this mentorship year could form the basis for an ongoing research consortium around systems modeling of the WEF nexus in Africa, catalyzing activities across the networks described above.

1 Albrecht, T. R., Crootof, A. & Scott, C. A. The Water-Energy-Food Nexus: A systematic review of methods for nexus assessment. *Environmental Research Letters* **13**, 043002, doi:10.1088/1748-9326/aaa9c6 (2018).