

KYLE FRANKEL DAVIS

Earth Institute Postdoctoral Fellow & NatureNet Science Fellow
The Earth Institute
Columbia University
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EDUCATION

- May 2016 University of Virginia
PhD, Environmental Sciences (Concentration: Hydrology)
Advisor: Paolo D’Odorico
- May 2010 University of Delaware
BS, Biochemistry (honors)

APPOINTMENTS

- 2016- Earth Institute Postdoctoral Fellow
Columbia University
Mentor: Ruth DeFries
- 2016- NatureNet Science Fellow
The Nature Conservancy
Mentors: Ruth DeFries, Brian Richter, and Joe Fargione

PUBLICATIONS

Published Journal Articles

- 2017 **Davis KF**, Rulli MC, Seveso A, D’Odorico P (2017) Increased food production and reduced water use through optimized crop distribution. *Nature Geoscience* **10**, 919–924.
- 2017 D’Odorico P, Rulli MC, Dell’Angelo J, **Davis KF** (2017) New frontiers of land and water commodification: socio-environmental controversies of large-scale land acquisitions. *Land Development and Degradation* **28**, 2234-2244.
- 2017 Laso-Bayas J-C, *et al.* including **Davis KF** (2017) A global reference database of crowdsourced cropland data collected using the Geo-Wiki platform. *Scientific Data* **4**, 170136.
- 2017 D’Odorico P, Natyzak JL, Castner EA, **Davis KF**, Emery K, Gephart JA, Leach AM, Pace ML, Galloway JN (2017) Ancient water supports today’s energy needs. *Earth’s Future* **5**, 515-519.
- 2017 **Davis KF**, Seveso A, Rulli MC, D’Odorico P (2017) Water savings of crop redistribution in the United States. *Water* **9**, 83.

- 2017 Rosa L, **Davis KF**, Rulli MC, D'Odorico P (2017) Environmental consequences of oil production from oil sands. *Earth's Future* **5**, 158-170.
- 2017 **Davis KF**, Rulli MC, Garrassino F, Chiarelli D, Seveso A, D'Odorico P (2017) Water limits to closing yield gaps. *Advances in Water Resources* **99**, 67-75.
- 2016 Chiarelli DD, **Davis KF**, Rulli MC, D'Odorico P (2016) Climate change and Large-Scale Land Acquisitions in Africa: Quantifying the future impact on acquired water resources. *Advances in Water Resources* **94**, 231-237.
- 2016 **Davis KF**, Gephart JA, Emery K, Leach A, Galloway JN, D'Odorico P (2016) Meeting future food demand with current agricultural resources. *Global Environmental Change* **39**, 125-132.
- 2016 Chiarelli DD, **Davis KF**, Rulli MC, D'Odorico P (2016) Global change in Africa: Climate change and large scale land acquisition. *Rivista Internazionale di Scienze Sociali* **131**, 463-472.
- 2016 Leach AM, Emery KA, **Davis KF**, Gephart JA, Carr JA, Pace ML, D'Odorico P, Galloway JN (2016) Environmental impact food labels combining carbon, nitrogen, and water footprints. *Food Policy* **61**, 213-223.
- 2016 Gephart JA, **Davis KF**, Emery K, Leach A, Galloway JN, D'Odorico P, Pace ML (2016) The environmental cost of subsistence: Optimizing diets to minimize footprints. *Science of the Total Environment* **553**, 120-127.
- 2015 **Davis KF**, Gephart JA, Gunda T (2015) Sustaining the food self-sufficiency of a nation: the case of Sri Lankan rice production and its environmental impacts. *Ambio* **45**, 302-312.
- 2015 **Davis KF**, Yu K, D'Odorico P, Carr JA, Herrero M, Havlik P (2015) Historical trade-offs of livestock's environmental impacts. *Environmental Research Letters* **10**, 125013.
- 2015 **Davis KF**, Yu K, Rulli MC, Pichdara L, D'Odorico P (2015) Accelerated deforestation driven by large-scale land acquisitions in Cambodia. *Nature Geoscience* **8**, 772-775.
- 2015 **Davis KF**, D'Odorico P (2015) Livestock intensification and the influence of dietary change: A calorie-based assessment of competition for crop production. *Science of the Total Environment* **538**, 817-823.
- 2015 **Davis KF**, Rulli MC, D'Odorico P (2015) The global land rush and climate change. *Earth's Future* **3**, 298-311.
- 2014 **Davis KF**, D'Odorico P, Rulli MC (2014) Moderating diets to feed the future. *Earth's Future* **2**, 559-565.
- 2014 **Davis KF**, D'Odorico P, Rulli MC (2014) Land grabbing: A preliminary quantification of economic impacts on rural livelihoods. *Population and Environment* **36**, 180-192.

- 2014 Debaere P, Richter BD, **Davis KF**, Duvall MS, Gephart JA, O'Bannan CE, Pelnik C, Powell EM, Smith TW (2014) Water markets as a response to scarcity. *Water Policy* **16**, 625-649.
- 2013 **Davis KF**, D'Odorico P, Laio F, Ridolfi L (2013) Global spatio-temporal patterns in human migration: A complex network perspective. *PLoS ONE* **8**, e53723.
- 2013 D'Odorico P, Bhattachan A, **Davis KF**, Ravi S, Runyan CW (2012) Global desertification: Drivers and feedbacks. *Advances in Water Resources* **51**, 326–344.

Manuscripts in Review or Revision

Davis KF, Chiarelli DD, Rulli MC, Chhatre A, Richter B, Singh D, DeFries R. Alternative cereals can improve water use and nutrient supply in India (In revision at *Science Advances*).

Chang X, DeFries RS, **Davis KF**, Liu L. Understanding dietary and staple food transitions in China from multiple scales (In revision at *PLOS ONE*).

D'Odorico P, **Davis KF**, Rosa L, Carr JA, Chiarelli DD, Dell'Angelo J, Gephart J, MacDonald GK, Seekell DA, Suweis S, Rulli MC. The global food-energy-water nexus (In revision at *Reviews of Geophysics*).

Rosa L, Rulli MC, **Davis KF**, D'Odorico P. Can the extraction of shale oil and gas threaten water and food security? (In revision at *Earth's Future*).

Davis KF, Bhattachan A, Suweis S, D'Odorico P. Predicting human migration from future sea level rise in Bangladesh (In review).

D'Odorico P, Carr JA, **Davis KF**, Seekell DA. Inequality, injustice, and the right to food (In review).

Srinivasan U, Velho N, Lee JSH, Chiarelli DD, **Davis KF**, Wilcove DS. India, oil palm, and the future of tropical biodiversity (In review).

DeFries R, **Davis KF**, Rao N, Chhatre A, Smith M, Myers S. Assessment of opportunities to reduce iron-deficient anemia from coarse cereals in the Indian diet (In review).

Rosa L, Rulli MC, **Davis KF**, Chiarelli DD, Passera C, D'Odorico P. Closing the yield gap while ensuring water sustainability (In review).

Rao N, **Davis KF**, M Poblete-Cazenave, Rutuja Bhalerao, S Parkinson, Chhatre A, DeFries R. Food grains, energy demand and GHG emissions in India (In review).

Davis KF, Singh D, Richter B, Fargione J, Chhatre A, DeFries R. The role of climate in yield variability of Indian cereals (In review).

Rulli MC, Casirati S, **Davis KF**, Dell'Angelo J, Passera C, D'Odorico P. Oil palm concessions as a driver of environmental degradation in Indonesian rainforests (In review).

Book Chapters

- 2018 **Davis KF**, Olayide OE “A Multidimensional Framework for Achieving Sustainable and Resilient Food Systems in Nigeria.” In Filho WL, Ayal D (Ed.) *Handbook of Climate Change Resilience* (Springer, Dordrecht, forthcoming).
- 2018 Vico G, **Davis KF** “Ecohydrology of agroecosystems – Interactions between global and local processes.” In D’Odorico P, Porporato A, Runyan C (Eds.) *Dryland Ecohydrology (2018 Revision)* (Springer, Dordrecht, forthcoming).
- 2018 **Davis KF**, Dalin C, DeFries R, Galloway JN, Leach AM, Mueller ND “Matching Production with Environmental Limits.” In Anderson J, Berry E, Birner R, Ferranti P, Galli A, Grace D, Hefferon KL, Serra-Majem L, Singer P (Eds.) *Encyclopedia of Food Security and Sustainability* (Elsevier, Amsterdam, forthcoming).

Professional Papers

- 2015 D’Odorico P, Rulli MC, Casirati S, **Davis KF**, Dell’Angelo J. Land use change induced by large scale land acquisitions. World Bank Conference on Land and Poverty, Washington DC, 23-27 March 2015.
- 2014 **Davis KF**, D’Odorico P. Does development dictate vulnerability? A global study of international migration and environmental change. Virginia Space Grant Consortium Annual Symposium, Norfolk, VA, 14 April 2014.

AWARDS AND HONORS

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| 2017 | Columbia University, The Earth Institute, Earth Institute Research Assistant Program: Deforestation and Large-Scale Land Acquisitions (\$1,800) |
| 2016- | The Nature Conservancy, NatureNet Science Fellow (\$50,000) |
| 2016 | University of Virginia, Department of Environmental Sciences, Maury Environmental Prize for outstanding graduate student (\$5,000) |
| 2015 | University of Virginia, Environmental Resilience and Sustainability Fellow (Mozambique) (\$8,000) |
| 2015 | USAID Research and Innovation Fellowship (Bihar, India) (\$10,000) |
| 2013-2016 | National Science Foundation Graduate Research Fellowship (\$150,000) |
| 2013-2015 | Virginia Space Grant Consortium Graduate Research Fellowship (\$10,000) |
| 2011 | University of Virginia, President’s Fellowship (\$50,000) |

2010-2011	Internship – Center for Sustainable Development (CESDEV), University of Ibadan (Nigeria)
2010	Elizabeth Dyer Award for Excellence in Biochemistry (\$2000)
2009	ESPN the Magazine/CoSIDA Academic All-America team, Men's Soccer
2007-2009	ESPN the Magazine/CoSIDA Academic All-District team, Men's Soccer

MENTORING

2017-	Koo, Hee Jin (Columbia University, BS)
2017-	Tatlhego, Mokganedi (University of California, Berkeley, PhD) (PhD committee member)
2017-	Max, Sage (Columbia University, BA) (Senior thesis mentor)
2016	Rosa, Lorenzo (Politecnico di Milano (Italy), MS)
2015	Seveso, Antonio (Politecnico di Milano (Italy), MS)
2015	Machava, Domingos (Universidade Eduardo Mondlane (Mozambique), MS)
2015	Chiarelli, Davide (Politecnico di Milano (Italy), MS)
2014	Ren, Jennifer (University of Virginia, BS)
2012	Frazier, Jerrica (University of Virginia, BS)

TEACHING

Columbia University (2016-present)

Ecological and Social Systems for Sustainable Development, The Earth Institute (guest lecturer)

University of Virginia (2011-2016)

Forest Hydrology, Department of Environmental Sciences (guest lecturer)

Dryland Ecohydrology, Department of Environmental Sciences (guest lecturer)

University of Delaware (2006-2010)

Introduction to Chemistry, Department of Chemistry and Biochemistry (teaching assistant)

LECTURES AND PRESENTATIONS

Davis KF, Olayide OE (2018) “Assessing climate-resilient and nutritious staple crops in Nigeria”, Oral Presentation, Centre for Sustainable Development, University of Ibadan, Nigeria (*Invited*).

Davis KF, DeFries R, Richter B, D’Odorico P, Singh D, Rao N, Chiarelli DD, Rulli MC, Chhatre A, Seveso A, Fargione J (2017) “A multidimensional approach to food production decision making”, Oral Presentation, American Geophysical Union Annual Meeting, New Orleans, Louisiana.

Rosa L, Rulli MC, **Davis KF**, D’Odorico P (2017) “The water-energy-food nexus of unconventional fossil fuels”, Poster, American Geophysical Union Annual Meeting, New Orleans, Louisiana.

Davis KF, DeFries R, Richter B, D’Odorico P, Singh D, Chiarelli DD, Rulli MC, Chhatre A, Seveso A, Fargione J (2017) “A multidimensional approach to food production decision making”, Oral Presentation, Earth Institute Postdoctoral Symposium, New York, New York.

Davis KF, Chiarelli DD, Richter B, Chhatre A, Singh D, DeFries R (2017) “Towards climate resilient and nutritious cereal crops in India”, Oral Presentation, American Association of Geographers Annual Meeting, Boston, Massachusetts.

Davis KF, Seveso A, Rulli MC, D’Odorico P (2016) “Towards a globally optimized crop distribution: Integrating water use, nutrition, and economic value”, Oral Presentation, American Geophysical Union Annual Meeting, San Francisco, California.

Davis KF, Seveso A, Rulli MC, D’Odorico P (2016) “Water savings of redistributing global crop production”, Oral Presentation, European Geophysical Union Annual Meeting, Vienna, Austria.

Davis KF, Yu K, Rulli MC, Pichdara L, D’Odorico P (2016) “Human and environmental impacts of land acquisitions in Cambodia”, Poster, Public Days, Charlottesville, Virginia.

Rulli MC, D’Odorico P, Chiarelli D, **Davis KF** (2015) “Water limited agriculture in Africa: Climate change sensitivity of large scale land acquisitions”, Oral Presentation, American Geophysical Union Annual Fall Meeting, San Francisco, California.

D’Odorico P, Rulli MC, Casirati S, **Davis KF**, Dell’Angelo J (2015) “Land use change induced by large scale land acquisitions”, Oral Presentation, Land and Poverty Conference, World Bank, Washington, D. C.

Davis KF, Yu K, D’Odorico P (2014) “Global livestock production: The importance of efficiency changes”, Poster, American Geophysical Union Annual Fall Meeting, San Francisco, California.

Davis KF, D’Odorico P (2014) “Does development dictate vulnerability? A global study of international migration and environmental change”, Oral Presentation, Virginia Space Grant Consortium Student Research Conference, Hampton, Virginia.

Davis KF, D’Odorico P, Rulli MC (2013) “Food security in the 21st century: Global yield projections and agricultural expansion”, Poster, American Geophysical Union Annual Fall Meeting, San Francisco, California.

Davis KF, D’Odorico P, Rulli MC (2013) “Global carrying capacity and sustainable development”, Oral Presentation, 4th Ibadan Sustainable Development Summit, Ibadan, Nigeria.

Davis KF, D’Odorico P, Rulli MC (2013) “Potential impacts of land grabbing on agricultural employment (and rural-urban migrations) in Africa”, Oral Presentation, 4th Ibadan Sustainable Development Summit, Ibadan, Nigeria.

Davis KF, D’Odorico P (2013) “Vulnerability indices for environmental human migration”, Poster, University of Virginia Dept. of Environmental Sciences EnviroDay 2013, Charlottesville, Virginia.

Davis KF, D’Odorico P (2012) “Lines of evidence for environmentally driven human migration”, Oral Presentation, American Geophysical Union Fall Meeting, San Francisco, California.

D’Odorico P, Carr JA, **Davis KF**, Laio F, Ridolfi L, Rulli MC, Suweis S (2012) “Water, people, and the environment “, Oral Presentation, American Geophysical Union Annual Fall Meeting, San Francisco, California.

Davis KF. “Human migrations, the environment and GIS” (2012) Oral Presentation, University of Virginia Scholars’ Lab GIS Day 2012, Charlottesville, Virginia.

Davis KF, Lee A, Zondlo NJ (2009) “Characterization of HIV-1 gp41 mimic six-helix bundle formation”, Poster, Undergraduate Summer Research Symposium, Newark, Delaware.

Davis KF, Bhor S, Zondlo NJ (2008) “Alpha–Helix mimics to inhibit HIV-1 membrane fusion”, Poster, Undergraduate Summer Research Symposium, Newark, Delaware.

ACADEMIC SERVICE

2017- Editor, *Frontiers in Sustainable Food Systems*

2014 Co-Convener, EnviroDay Graduate Student Conference, Department of Environmental Sciences, University of Virginia

2012 Editor, *African Journal of Sustainable Development*

Ongoing Reviewer: *Advances in Water Resources; Agricultural and Forest Meteorology; Ambio; Conservation Letters; Earth’s Future; Environmental Development; Environmental Research Letters; Environmental Science and Policy; Global Biogeochemical Cycles; Global Environmental Change; Livestock Science; PLOS ONE; Royal Society Open Science; Science Advances; Science of the Total Environment; Sustainability; Sustainability: The Journal of Record; Trends in Food Science and Technology; Water Resources Research; World Development*

MEDIA

- 2017 Research highlighted in: *Phys.org, EurekaAlert!, WIRED, MIT Technology Review, Environmental Research Web, Arstechnica, Technology Review, Environmental News Network, SeedQuest, Nature Asia, Zimbabwe Star, Lab Manager, Green Report, Food Navigator, Climate News Network*
- 2016 “Dietary changes will help more sustainable agriculture meet increased global food demand.” Issue 478. *Science for Environment Policy* (European Commission), 25 November 2016.
- 2015 “The changing world of meat production.” Earth Day feature. *Weather Underground*, 22 April 2015.

PROGRAMMING AND COMPUTING SKILLS

Matlab, R, ArcGIS, SPSS, CropWat, Google Earth Engine, QGIS

Research Statement

Kyle F. Davis

I am an environmental scientist who focuses on the socio-environmental impacts of the global food system. My interests lie at the intersection of food security, livelihoods, and global environmental change. I use spatial datasets, crop water models, geospatial tools, and statistical techniques to quantify the impacts and tradeoffs of food production and to investigate solutions for sustainable, climate-smart, and equitable agricultural systems.

Dissertation Research: My dissertation work focused on understanding tradeoffs among the dimensions of food security, livelihoods, and the environment. I first examined historical competition for crop use between food and feed, finding that improved feed conversion efficiency combined with reduced consumer waste of animal foods could lower crop demand for animal production by 32% (Davis and D’Odorico 2015 *Science of the Total Environment*). I found that efficiency gains within the livestock sector in terms of greenhouse gas emissions and land use were offset by greater irrigation and fertilizer demands per unit of animal production (Davis et al. 2015 *Environmental Research Letters*). I also investigated the influence of recent agricultural investments on rural communities and the environment in developing nations (Davis et al. 2015 *Population and Environment*). I performed the first quantitative assessment linking land use changes with large-scale land deals using a georeferenced dataset of economic land contracts in Cambodia. Combining high-resolution forest cover data with a covariate matching technique – a spatial approach that controls for all variables that may influence forest loss – I found that annual rates of forest loss within these land deals were 29% to 105% higher than in comparable non-concession areas (Davis et al. 2015 *Nature Geoscience*). Having investigated historical socio-environmental impacts of the global food system, I then examined how proposed solutions might promote future food system sustainability. Using global datasets and hydrologic models, I found that enhancing crop yields on currently cultivated lands could feed 2.1 to 3.1 billion more people (Davis et al. 2014 *Earth’s Future*) but would entail doubling irrigation water demand (Davis et al. 2017 *Advances in Water Resources*). Employing production- and consumer-side solutions in tandem, I showed that less environmentally impactful diets and increasing resource use efficiency could meet future food demand while reducing water use and emissions from agriculture below current levels (Davis et al. 2016 *Global Environmental Change*).

Completed Postdoctoral Research: My current work has focused on developing spatially-explicit, multidimensional, data-intensive approaches for agricultural decision making. A host of factors influence a farmer’s decision of where, when, and what to plant, including input costs and subsidies, natural resource availability, market prices, dietary preferences, and local knowledge. Given that these decisions – and the agricultural policy landscapes in which they occur – are not necessarily targeted at nutrition or environmental sustainability, I examined how crops might be redistributed on currently cultivated lands if water use and nutrition were prioritized. Using a process-based crop evapotranspiration model and global gridded crop production maps, I estimated the current nutritional production and consumptive water use of major crops across the planet. I then employed a spatial optimization approach to identify alternative crop configurations within current rainfed and irrigated croplands based on water consumption, nutritional content, and price. I found that redistributing crops could feed an additional 825 million people and reduce the consumptive use of rainwater and irrigation water by 14% and 12%, respectively (Davis et al. 2017 *Nature Geoscience*). This approach would not entail a loss of crop diversity, cropland expansion, or impacts on feed availability nor require a switch from smallholder farming to large-scale commercial agriculture. Having demonstrated the promise of this multidimensional framework for increasing the climate resilience of small-scale farmers in water-stressed agricultural regions, I then examined its efficacy at policy-relevant scales in populous developing countries. I developed high-resolution crop-specific evapotranspiration maps in India to explore the water and nutritional benefits of replacing rice – a nutrient-poor, highly subsidized staple – at the district level with alternative grains grown in the country (e.g., maize, sorghum, millets). I showed that incorporating alternative grains can reduce water use by as much as 24% and greatly enhance protein, iron, and zinc supply (Davis et al., *in revision*). Using

plot-level data of over 80,000 yield measurements and gridded climate and soil datasets, I have also employed linear mixed effects models to assess the sensitivity of Indian grain yields to variability in rainfall and temperature (Davis et al., *in review*). In collaboration with colleagues at the Indian School of Business, this work will be complemented by choice experiments to examine the consumer-side viability of increased alternative grain availability. I am also collaborating on studies examining what historical transitions in grain production have meant for India's greenhouse gas emissions, energy requirements, and rates of anemia. I am also leading similar work in Nigeria collaborating with researchers at the University of Ibadan and government officials in the Ministries of Agriculture and the Environment to examine the outcomes of potential agricultural policy pathways in terms of water and energy use, greenhouse gas emissions, nutritional output, and climate resilience.

Ongoing and Future Research: My work will continue to develop and apply geospatial tools to addressing socio-environmental challenges at the interface of food security, society, and environment in the context of sustainability and global change. These analytical approaches will be complemented by international collaborations and stakeholder engagement, the combination of which is central to my research. My work offers a wealth of opportunities for future scientific pursuits and will encourage rich and diverse collaborations within the Data Science Institute and across the University. Several potential lines of inquiry include:

Can data science be used to inform agricultural policy through a multidimensional framework?

Agricultural policies rarely (if ever) have a singular focus, reflecting the attempt by policymakers to reconcile the economic, social, and environmental values of a society. These manifold concerns pose a broader challenge regarding how best to consider multiple food security and environmental objectives while developing cohesive policies aimed at food system sustainability. To aid in resolving these often conflicting goals, I am utilizing my recent work on the production of grains in India – and their associated water demands, energy use, greenhouse gas emissions, nutritional quality, and climate sensitivity – to develop novel Pareto optimality techniques for identifying scenarios that increase nutritional output, enhance rural livelihoods, and reduce the environmental burden of Indian agriculture. Future work will apply this approach to other nations and policy landscapes and will examine the most effective means for conveying this information to policymakers and the general public.

What are the spatial and temporal limitations on water availability and crop yield gap closure?

Building on previous work estimating the future water demands of maximizing crop yields, I am now using high-resolution monthly gridded estimates of water availability and demand to examine current and future water scarcity, to identify agricultural regions where supplementary irrigation can be provided to existing croplands without affecting environmental flows, and to estimate additional energy requirements and emissions associated with such irrigation expansion. On one hand, this will identify the agricultural areas in which decision makers can promote the sustainable intensification of food production, and on the other hand, this will highlight regions where a dearth of freshwater resources will make increased crop production environmentally untenable or require a switch to crops with greater water use efficiency. This work will also explore temporal trends in the inter- and intra-annual variability of crop irrigation requirements and regional water stress.

To what extent will climate change impacts shape human migrations, and what are the likely sources and destinations of these migrants?

A large fraction of households in developing countries rely on agriculture as a primary income source. Because of this direct linkage between livelihoods and the environment, I am studying how climate change impacts on agricultural lands – whether through enhanced water stress, or through soil salinization or direct inundation from sea level rise – may induce rural inhabitants to move as an adaptation strategy for income diversification. I have developed a parameter-free diffusion-based probabilistic model of human mobility which, when combined with datasets on population, topography, and climate, provides estimates of the sources, destinations, and flux of potential migrants as driven by future sea level rise in Bangladesh (Davis et al. *in review*). With this information, decision makers in likely destinations can better anticipate these additional arrivals and take necessary planning steps in turn. Future work will seek to apply this modeling framework to other situations in which out-migration driven by climate change is likely to occur.

Teaching Statement

Kyle F. Davis

Teaching Philosophy: My three primary learning objectives are 1) to convey understanding of and appreciation for the intimate linkages between humans and the environment, 2) to equip students with quantitative tools to explore their own scientific curiosity, and 3) to engender in them a critical, scientific perspective in absorbing knowledge. These objectives guide all of my interactions with students, as I seek to make their knowledge of environmental sciences and sustainability relevant to their everyday experiences and to present them with challenges that require the application of knowledge across multiple fields. I also encourage them to combine their scientific knowledge with increased civic engagement and community service. I have engaged in a variety of valuable teaching experiences, from guest lectures to curriculum development to the supervision of class research projects. In one example, I worked with students in a *Dryland Ecohydrology* course to develop a collective research study of interest to the class. The students decided to quantify the competition for crop calorie production between human and livestock use and to assess the pressure placed on rangelands for animal production. Through this project, students were introduced to various analytical tools (e.g., ArcGIS, Matlab, SPSS) and asked to provide ways in which their findings might inform policy steps toward achieving a more sustainable livestock sector. I plan to employ a similar participatory, problem-based learning pedagogy, as I feel it is through this type of approach that students become most engaged with course material, can best exercise their scientific curiosity in a topic, and can realize their potential to ask and answer research questions through quantitative data analysis.

Courses: My interdisciplinary training leaves me well-equipped to teach a variety of topics at graduate and undergraduate levels related to Data Science and Sustainability. The courses that I develop would dovetail with current curricula and expand offerings in the area of human-environment interactions, food and water security, sustainability, and quantitative data analysis. One undergraduate course I would develop is *Sustainability in the Food-Energy-Water Nexus* in which I would provide a scientific basis for understanding the interactions between food production, energy use, and freshwater resources as well as what their implications are for the environment and rural livelihoods. This course would focus on the global food system in the context of global environmental change, explore concepts of environmental sustainability, and examine solutions for feeding humanity while reducing our environmental footprint. A graduate course I would offer is *Geospatial Solutions for Socio-Ecological Challenges*, which will explore various human-environment interactions, such as agriculture, land use change, drought stress and adaptation, water resource availability and use, and the integration of nutritional and environmental objectives, through the analysis of geospatial datasets. This course will leverage students' existing knowledge of ArcGIS as well as provide technical training in the use of QGIS and Google Earth Engine platforms. Both courses would incorporate local examples from the Mid-Atlantic and combine extensive reading of the current scientific literature with substantial data analysis and independent project development. In addition, while the classroom is vital for the transfer of knowledge, real-world experiences can effectively broaden perspective, engender understanding, and encourage creative and innovative solutions – all of which will be valuable qualities for any chosen path for my students. Particularly in developing countries, economic, political, infrastructural, and environmental difficulties interact to affect food security, livelihoods, access to water, and availability of agricultural technologies. Thus, I would also pursue study abroad opportunities that expose students to the various challenges of achieving food security and sustainability in the developing world.

Mentoring Philosophy: Support and creativity will be fundamental to my lab group culture. The direction of my group will be guided by several central themes upon which I will promote student independence, innovative and ambitious thinking, collaboration, and interdisciplinarity. To facilitate my students' development as independent scientists as well as the open exchange of ideas, my approach towards mentorship of valuing student input and being forthright about the extent of my knowledge and expertise has served me well. In this way I not only empower students to explore thought-provoking topics about which they are most passionate but also greatly aid in my own learning. I will also provide frequent guidance to my mentees regarding possible career pathways and encourage their engagement in various professional activities that will equip them for career opportunities within and outside of academia. I also strongly believe in a healthy work-life balance and will encourage and support my students' non-academic interests.