

## Ecological and Human Health in Rural Communities

### Steering Committee:

Julia Gohlke, Population Health Sciences (CVM)<sup>1,2,3,4,5,6,7,8</sup>  
Korine Kolivras, Geography (CNRE)<sup>1,2,4,6,7</sup>  
Leigh-Anne Krometis, Biological Systems Engineering (CALs)<sup>1,2,4,6,7,8,9,10</sup>  
Susan Marmagas, Population Health Sciences (CVM)<sup>1,2,3,5,6,7,9</sup>  
Linsey Marr, Civil and Environmental Engineering (COE)<sup>1,2,4,6,7</sup>  
Emily Satterwhite, Appalachian Studies, Religion and Culture (CLAHS)<sup>1,2,6,7</sup>

### Affiliates:

Paul Angermeier, Fish and Wildlife Conservation (CNRE)<sup>8,10</sup>  
Susan Clark, Horticulture (CALs)<sup>6</sup>  
Shyam Ranganathan, Statistics (COS)<sup>4</sup>  
Stephen Schoenholtz, Forest Resources and Environmental Conservation (CNRE)  
Samarth Swarup, Network Dynamics and Simulation Science Laboratory (BI)  
Chris Thompson, Neurosciences (COS)

Previous collaborations relevant to this concept (see funding details in Table 2 in Appendix II):

<sup>1</sup> Application to form NIH/EPA Center on Environmental Health Disparities (2015)

<sup>2</sup> GCC/ISCE Seed Grant on landscape change and ecological health in Tazewell County (2016)

<sup>3</sup> VDH/EPA Tazewell County Radon Project (2016)

<sup>4</sup> R21 application to NIH (2016)

<sup>5</sup> ICTAS Diversity Seed Grant (2017)

<sup>6</sup> Extreme Appalachia Conference (2017)

<sup>7</sup> Article on Central Appalachian environmental health disparities in press at *Reviews on Environmental Health* (2017)

<sup>8</sup> GCC Environmental Justice book club

<sup>9</sup> Tazewell County Cancer Project (Tazewell County Board of Supervisors) (2014)

<sup>10</sup> GCC/ISCE Seed Grant on water quality, ecological health, and human well-being (2016)

Vision: Environmental exposures to chemicals and microbes in the air we breathe, the water we drink, the food we eat, and the objects we touch are now recognized to be responsible for 90% of all human illness. This suggests that well-documented health disparities within and between nations have significant geographic and ecological as well as socioeconomic dimensions that must be addressed in order to secure human well-being at local to global scales. While urbanization is a primary driver of global change, it is widely acknowledged that urbanization is dependent on large-scale resource extraction and agriculture in rural communities. **Despite considerable evidence linking human industrial and agricultural activities to ecological health (i.e. health of an ecosystem including the non-human organisms that inhabit it), very little data are available directly linking exposure to environmental pollution and human health in rural areas, which have repeatedly been identified as subject to the most extreme health disparities.**

Building on existing interdisciplinary strengths in environmental science, natural resources, and public health, Virginia Tech is poised to pursue urgent unanswered questions regarding the linkages between humans' well-being and the conditions of the broader ecologies they inhabit in rural areas. This initiative's education, research, and engagement activities will focus initially on Central Appalachia, which is simultaneously known for unique ecological richness and dramatic landscapes as well as recalcitrant health disparities that cannot be fully explained by socio-behavioral factors. As the initiative grows, activities will expand to rural communities worldwide, including portions of India, China, Malawi, and Ecuador, where we can build on existing investments by the university. We are also motivated by the motto *Ut Prosim* to serve the surrounding region and fulfill Virginia Tech's mission as a land grant university with global reach, going "beyond boundaries." Central research questions and themes of this initiative include:

1. *Are ecological health indicators (e.g. species diversity) predictors of human health in nearby communities and vice versa?*
2. *How do long-term exposures to different combinations of environmental contaminants affect human and ecological health across generations?*
3. *How can researchers and educators best connect with communities to (a) inform and support their decision-making and (b) strengthen the opportunity for community voices to influence research priorities, policy, and education?*

Relevance: The global trend toward urbanization makes it easy to overlook rural areas, yet 3.4 billion people live in rural areas, and these areas remain critical for energy and food production. Because the sustainability of many rural communities depends heavily on local natural resources, the areas' biogeophysical and sociocultural spheres are particularly intertwined, **demanding a global systems approach.** This concept integrates five of the critical problems that have been identified as strengths of the GSS DA: pressure on forest ecosystems and watersheds, demands for raw materials, abundance and quality of fresh water, defaunation and biosphere integrity, and degradation of ozone and aerosol loading.

Some of the most severe health disparities in the US occur in rural Appalachia, particularly in Central Appalachia just miles from Virginia Tech. **Most studies of environmental quality in the region focus on the preservation of biodiversity while ignoring human health. The limited studies available do not measure people's exposure to contaminants, constraining the ability to identify causal relationships between environmental conditions and public health.** The National Academies of Science has recognized this gap in knowledge and is evaluating evidence of human health effects from surface coal mining operations in Central Appalachia. Future efforts must engage community members in examining all potential sources of environmental health disparities, from resource extraction, forestry, and agricultural land uses, to identify effective policies for improving human and ecological health.

The benefits of engaging with neighboring Central Appalachia are twofold: (1) the region serves as an ideal testbed for the research questions and themes listed above, and (2) we can provide support for residents to improve both ecological and human health. By integrating the distinct and rich fields of ecotoxicology and human toxicology, we can compare parallel model systems in both laboratory- and field-based research. This concept integrates the three methodologies of the GSS DA: biogeophysical (e.g. remotely sensed and in situ sensors measuring geophysical parameters, ecological health metrics), sociocultural (e.g. oral history collection, population health metrics from vital records), and tools and technologies (e.g. data analysis structures incorporating remotely sensed datasets, data collected from wearable sensors). This initiative's focus on chronic disease will complement the new GSS emphasis on infectious disease.

There are rich opportunities for Center-level extramural funding from both governmental and non-governmental sponsors, including the NIH, Gates Foundation, Robert Wood Johnson Foundation, NASA, NSF, and US Environmental Protection Agency (EPA) (**Appendix II, Table 1**). This concept would be especially attractive to philanthropic organizations, and one of the EPA's goals is harmonization of human and ecological risk assessment methods in order to enhance the science behind decision-making, as suggested by the National Academies of Science. We previously submitted an application to NIEHS to establish a \$5 million center on environmental health disparities. While not funded, **our proposal's scientific review was positive, and NIEHS staff suggested that further programmatic investment at the university level would enhance our competitiveness in the future.**

We foresee substantial connections with three other destination areas:

*Data Analytics and Decision Sciences:* As an example, ongoing projects integrate remotely sensed data and field data collected on activity patterns of humans living in urban and rural settings into synthetic population models to assess environmental exposures and develop multi-level statistical approaches for integrating remotely sensed data, toxicology datasets, and vital records datasets to estimate exposure and responses to those exposures.

*Intelligent Infrastructure for Human-Centered Communities:* Advances in both residential and workplace infrastructure have enormous potential to sense and control environmental conditions that affect human health and productivity. Built-in sensors could provide the critical data needed for quantification of the risk associated with mountaintop removal coal mining, for instance, or could warn residents if their drinking water source requires attention to reduce metals or pathogens.

*Adaptive Brain and Behavior:* There is growing concern that environmental contaminants may contribute to increased incidence of behavioral disorders by compromising cellular and molecular mechanisms that are necessary for normal brain development. For instance, compounds from agricultural and surface mining sites may increase risk for developmental behavioral disorders such as ADHD, which occurs in Appalachia at higher rates than the US average. This concept will evaluate compounds of concern for their effects on mechanisms of brain development in animal models.

Moreover, our work to identify and address health disparities according to geography, social class, and race will promote, and require substantive linkages to, the Strategic Growth Areas in *Policy and Equity and Social Disparity in the Human Condition*.

Curriculum Opportunities: We will develop a capstone course featuring community engagement and focused on intertwined challenges to ecological and human health. Given our reach into humanities and social sciences, we have the resources to offer "an introductory, interdisciplinary, team-taught and problem-based exploratory course in Systems Thinking,

grounded in systems science but taking advantage of significant resources in the liberal and performing arts and social sciences,” as described in the GSS white paper proposal. Our research team’s course offerings can be featured in three Pathways minors: Sustainability, Civic Agriculture and Food Systems, and Appalachian Cultures and Environments. Our work would help recruit students to Virginia Tech to pursue studies at the intersection of ecological and human health within CNRE/CALS/COE, and the new B.S. in Public Health (VetMed).

Additional resources towards our concept would strengthen existing graduate degrees in, and promote interdisciplinary conversations among Public Health, Biological Systems Engineering, Geography, Civil and Environmental Engineering, History, and Material Culture and Public Humanities. Additional curriculum development might include new cross-disciplinary engaged learning courses in Human and Ecological Health in Appalachia that leverages Virginia Tech’s renown in science and engineering, its growing public health stature, and its geographic proximity to past and future resource extraction industries.

Description of Resource Needs: This initiative does not require additional space at the main campus beyond that required to support the laboratories of new faculty hires, but a new field station in Central Appalachia would help support our goals. To gain preeminence in this concept area, faculty hires should target the following expertise: (1) environmental epidemiology focused on using remotely sensed datasets and spatial analytical approaches, (2) aquatic toxicology focused on chronic toxicity endpoints and mixtures exposures that result from large-scale landscape changes, (3) demography that examines human and wildlife population migrations and changes, (4) human and ecological risk assessment with a focus on integration of quantitative methods for determining safe levels of exposure across species, (5) oral history whose focus areas of interest include digital humanities, public history, and local/regional history. Additional hires at a later date would be in the areas of environmental psychology, rural policy, ecosystems modeling, soil toxicology, sustainable food systems, environmental economics, and health education, as described in **Appendix III**.

## Appendix I: Biosketches

**BIOGRAPHICAL SKETCH**

Provide the following information for the Senior/key personnel and other significant contributors.  
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Gohlke, Julia M

eRA COMMONS USER NAME (credential, e.g., agency login): jgohlke

POSITION TITLE: Assistant Professor of Environmental Health

EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.*)

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
University of Michigan, Ann Arbor, MI	B.S.	12/1997	Biology
University of Washington, Seattle, WA	M.S.	12/2001	Environmental Health
University of Washington, Seattle, WA	PhD	12/2004	Environmental Health
National Institute of Environmental Health Sciences, RTP, NC	Postdoc	08/2009	Environmental Health

**A. Personal Statement**

For the Global Systems Science destination area concept in rural health, Dr. Gohlke's expertise in environmental exposure measurement in environmental epidemiology and toxicity pathways will play a critical role to the development of the theme. Her broad depth of knowledge in environmental health is established by research methods she employs, which includes utilization of epidemiological, bioinformatics, and toxicology techniques. She is currently performing research on the effects of human exposure to high temperatures and volatile organic compounds in urban versus rural settings in Alabama. As PI of an R21 award under the inaugural NIH Climate Change and Health Program, and subsequent R01 awardee, her research team is developing risk estimates for preterm birth and non-accidental mortality using 20 years of Alabama birth and death records, satellite-derived climate data, and personal exposure techniques. Her previous work developed hypothesis generating bioinformatics techniques combining genomics and genetics datasets to prioritize environmentally regulated molecular pathways. She is also well-versed in experimental techniques and is using *Daphnia pulex* (a standard ecotoxicology model system, but rarely used to estimate human health effects) to examine the combinatorial effect of exposure to a mixture of chemicals or other stressors on lipid storage, reproduction, and lifespan. The short lifespan and ease with which multi-generational effects can be evaluated makes *Daphnia pulex* an excellent alternative model system for prioritizing potential toxicants for further research in linking human and ecological health.

**B. Positions and Honors****Positions and Employment**

08/98 to 12/98	Research Assistantship	University of Michigan, Ann Arbor, MI
06/01 to 09/01	Research Assistantship	University of Washington, Seattle, WA
03/02 to 06/02	Research Assistantship	Environmental Protection Agency, RTP, NC
09/02 to 12/02	Teaching Assistantship	University of Washington, Seattle, WA
2002 to 2004	Research Assistantship	University of Washington/EPA, Seattle, WA
2002 to 2004	Research Internship	Environmental Protection Agency, RTP, NC
01/05 to 08/09	Postdoctoral Fellowship	NIEHS/ National Institutes of Health, NC

07/08 to 08/08	Temporary Advisor	World Health Organization, Switzerland
09/09 to 08/10	AAAS Fellow	Department of State, Washington DC
8/10 to 07/15	Assistant Professor	University of Alabama at Birmingham
8/15 to present	Assistant Professor	Virginia Polytechnic Institute and State University

### **Other Experience and Professional Memberships**

2017-	Editorial Review Board, <i>Environmental Health Perspectives</i>	
2017-2018	Member of the NAS <i>Committee on the Evaluation of the Use of Chemical Dispersants in Oil Spill Response</i>	
2012-2015	Member of the Board of Scientific Counselors, National Center for Environmental Health/Agency for Toxic Substances and Disease Registry	
2016	Army Corps of Engineers Engineer Research and Development Center FY 16 Basic Research Proposal Reviews	
2016	NIOSH Special Emphasis Panel (PAR 15-353: Centers for Agricultural Safety and Health)	
2016	NASA ROSES 2015 A.46 Health and AQ Applied Sciences Team (H-AQAST) review panel	
2015	Environmental Protection Agency, Science to Achieve Results (STAR) Graduate Fellowship Program review panel member	
2014-	Editorial Board member, <i>Journal of Health and Pollution</i> , Blacksmith Institute, NY	
2014-	Review Editor, <i>Frontiers in Public Health-Radiation and Health</i> specialty section, Frontiers, Lausanne, Switzerland	
2014	Invited Reviewer: National Science Foundation Graduate Research Fellowship Program	
2013,2012	Invited Reviewer: NIH Climate Change and Health Special Emphasis Panel (ZRG1 PSE-D (56)), NIH Behavioral Interventions to Address Multiple Chronic Health Conditions in Primary Care (ZRG1 HDM-T(02)); Army Corps of Engineers Engineer Research and Development Center FY 14 Basic Research Proposal Reviews; EPA's draft "Next Generation Risk Assessment: Incorporation of Recent Advances in Molecular, Computational, and Systems Biology Interim Report."	
2008-2012	Editorial Board member, <i>Reproductive Toxicology</i> , Elsevier, NY	
2011-	Gulf of Mexico Reef Fish Shareholders' Alliance Advisory Board member	
2010	Ad Hoc Expert Reviewer, Centers for Disease Control and Prevention, Environmental Health Tracking Branch, Atlanta GA	
2009-2010	Member of the U.S. Interagency Working Group on Climate Change and Health	
2009	External Review Panel Member for EPA Toxicogenomics in Risk Assessment Report	
2006-	Invited Reviewer (out of 38 journals): <i>Nature Communications, Nature Energy, BMC Public Health, American Journal of Public Health, Environmental Health Perspectives, Neurotoxicology, Current Anthropology, Birth Defects Research, BMC Emergency Medicine, Journal of Exposure Science and Environmental Epidemiology, Gene Regulation and Systems Biology, Toxicological Sciences, Food and Chemical Toxicology, Obesity, Mathematical Biology, Reproductive Toxicology, Frontiers in Public Health, Journal of Occupational Medicine and Toxicology, Neurobiology of Aging, Science of the Total Environment, Toxicology and Applied Pharmacology, International Journal of Environ Res Public Health, Regional Environmental Change, American Journal of Human Biology, American Journal of Clinical Nutrition, Frontiers in Ecology, Archives of Environmental and Occupational Health, Aging Cell</i>	
1999-	Society of Toxicology and Teratology Society member	

### **Honors**

2001-2006	Eight Society of Toxicology, Teratology Society, Society for Risk Analysis awards for papers, presentations, and posters of predoc and post-doc research results.
2009	Best Publication in <i>Birth Defects Research</i> in 2008

- 2011 Invited participant in NIH Director's 'Innovation Brainstorm: Transforming Discovery into Impact' to develop ideas for scientific programs for the NIH Common Fund
- 2011 Invited participant in NIEHS Strategic Planning meeting, July 12-14<sup>th</sup> and Oct 13-14<sup>th</sup>, RTP, NC
- 2011 Winner of UAB NORC "Creativity is a Choice" Award
- 2013 Future Leader Award, International Life Sciences Institute, N.A.
- 2014 F. Clarke Fraser New Investigator Award, Teratology Society, Reston, VA
- 2016 First prize, NIEHS Climate Change and Environmental Exposures Challenge for PIE Viz, Populations, Infrastructures, and Exposures Visualization Tool with Samarth Swarup and Dawen Xie, Biocomplexity Institute, VT

### C. Contributions to Science

**Throughout my career, my primary interest has been determining how environmental processes impact health outcomes. To pursue this interest I have employed a variety of toxicological, epidemiological, computational, and bioinformatic approaches.**

**Quantitative methods for estimating interspecies differences in brain development.** Early in my career, I was interested in understanding how datasets generated in model species can be used to predict effects in humans. The current methods for determining risk associated with environmental pollutants relies heavily on testing conducted in rodent species. Chemicals are evaluated for neurodevelopmental effects through exposure in rodents and subsequent behavioral testing and pathology exams. Compared to the neocortex of the rodent brain, the primate neocortex is overdeveloped and this is thought to underlie higher order processes such as executive functioning present in primates but not rodents. To address this translational issue, I developed computational models to predict neuronal cell number in the developing rat, mouse, monkey, and human neocortex based on cell cycle kinetics and apoptosis during neurogenesis. We examined the effects of ethanol on neuronal proliferation, differentiation, and death as a case study for use in assessing the risk of chemicals using rodent datasets to predict effects in humans.

- Gohlke JM, Griffith, WC, & Faustman, EM (2005). A systems-based computational model for dose-response comparisons of two mode of action hypotheses for ethanol-induced neurodevelopmental toxicity. *Toxicological Sciences*, 86(2), 470-484
- Gohlke JM, Griffith, WC and Faustman, EM (2007). Computational Models of Neocortical Neuronogenesis and Programmed Cell Death in the Developing Mouse, Monkey and Human. *Cerebral Cortex*, 17: 2433-2442

**Bioinformatic techniques for disseminating the molecular underpinnings of environmental effects on human health.** After exploring interspecies differences in cellular processes during neocortical development, I became interested in understanding the molecular changes necessary to produce these cellular differences. Collaborating with Francois Guillemot's lab, who produced transcriptomics datasets in several proneural bHLH loss of function and gain of function mice, I was able to develop a gene regulatory network describing differentiation into glutamatergic and GABAergic neurons. This work led to a broader application of network theory and pathway analysis to define hypotheses of the most likely molecular targets of environmental factors affecting disease processes based on available datasets from genetic association studies in humans and toxicology studies performed in rodent and other model organisms. We are currently evaluating lifespan and transcriptomic differences associated with early-life exposures to mixtures using *D. pulex* as a model organism.

- Gohlke, JM, O Armant, FM Parham, MV Smith, D Castro, L Nguyen, JS Parker, G Gradwohl, CJ Portier, F Guillemot. (2008). A Gene Regulatory Network for Telencephalon Development Combining Experimental and Bioinformatics Approaches. *BMC Biology* 6(1): 15. PMID: PMC2330019
- Gohlke JM, R Thomas, Y Zhang, MC Rosenstein, AP Davis, C Murphy, CJ Mattingly, KG Becker, CJ Portier (2009). Genetic and Environmental Pathways to Complex Diseases. *BMC Systems Biology* 3: 46. PMID: PMC2680807
- Thomas R, JM Gohlke, F Parham, CJ Portier. (2009). Choosing the right path: Enhancement of biologically-relevant sets of genes or proteins using pathway structure. *Genome Biology* 10(4):R44. PMID: PMC2688935
- Hudson SL, DA Doke, JM Gohlke. (2016). The effect of a low iron diet and early life methylmercury exposure in *Daphnia pulex*. *Food Chem Toxicol.* 89: 112-119. PMID: 26806633.

- Schwartz TS, P Pearson, J Dawson, DB Allison, JM Gohlke. (2016). Effects of fluctuating temperature and food availability on reproduction and lifespan. *Experimental Gerontology* 86: 62-72.

**Human health implications of global environmental change.** Traditionally the field of environmental health has focused on health outcomes associated with exposure to single chemicals. More recently, large-scale changes in the environment such as climate change, urbanization, and land use change have been characterized by earth and physical scientists but have been largely unexplored by human health scientists. I have developed a research program examining health outcomes associated with large-scale environmental changes across urban and rural landscapes. Using a combination of satellite-derived datasets and vital records, we have confirmed associations between mortality and extreme heat events and we were also able to detect an association between preterm birth and extreme heat events. Importantly, we were able to detect mediation of the association by rurality, suggesting persons in urban centers may be more at risk. To assess adaptation strategies in human populations, community engaged research is being conducted in underserved urban and rural communities in Alabama, where we have piloted a method for measuring individual level exposure using a small device attached to the shoe.

- Gohlke JM, R Thomas, A Woodward, D Campbell-Lendrum, A Prüss-Üstün, S Hales, CJ Portier. (2011). Estimating the global health implications of electricity and coal consumption. *Environ Health Perspect.* 119(6): 821-6. PMID: PMC3114817
- Smith, TT, BF Zaitchik, JM Gohlke. (2013). Heat waves in the United States: definitions, patterns and trends. *Climatic Change* 118: 811-825 PMID: PMC3711804
- Kent ST, McClure LA, Zaitchik BF, Smith TT, & JM Gohlke. (2013). Heat Waves and Health Outcomes in Alabama (USA): The Importance of Heat Wave Definition. *Environ Health Perspect.* 122(2): 151-8 PMID: PMC3914868.
- Bernhard, MC, ST Kent, MA Sloan, MB Evans, McClure LA, JM Gohlke. (2015). Measuring personal heat exposure in an urban and rural environment. *Environmental Research* 137: 410-418 PMID: PMC4355189.
- Swarup S, JM Gohlke, JR Bohland. (2017). A microsimulation model of population heat exposure. Conference Proceedings of the 2<sup>nd</sup> International Workshop on Agent-based modelling of urban systems (ABMUS), São Paulo, Brazil, May 2017.
- Krometis LA, JM Gohlke, K Kolivras, E Satterwhite, SW Marmagas, L Marr. 2017. Environmental Health Disparities in the Central Appalachian Region of the United States. *Reviews in Environmental Health.* Accepted.

**Assessing human health risk after a large-scale oil spill.** Applying my expertise in risk assessment, I evaluated seafood safety protocols used following the Deepwater Horizon blowout. After outlining a set of data gaps and recommendations for further state and federal monitoring, samples collected from fishermen were also evaluated and compared to federal level testing. Our assessment concluded there was minimal human health risk associated with seafood consumption after waters were re-opened for fisheries.

- Gohlke JM, D Doke, M Tipe, M Leader, T Fitzgerald. (2011). A review of seafood safety after the Deepwater Horizon blowout. *Environ Health Perspect.* 119(8): 1062-9 PMID: PMC3237364
- Fitzgerald TP, JM Gohlke. (2014). Contaminant levels in Gulf of Mexico reef fish after the Deepwater Horizon oil spill as measured by a fishermen-led testing program. *Environ. Sci. Technol.*48(3): 1993-2000 PMID: 24401096
- Sathiakumar N, M Tipe, A Turner-Henson, L Chen, M Leader, J Gohlke. (2017). Post-Deepwater Horizon blowout seafood consumption patterns and community-specific levels of concern for selected chemicals among children in Mobile County, Alabama. *Int. J. Hyg. Environ. Health* 220 (1): 1-7

#### List of published work in Google Scholar:

<https://scholar.google.com/citations?hl=en&user=RKwPrDoAAAAJ>

#### D. Research Support

##### Ongoing Research Support

NIH/NIEHS R01ES023029

Gohlke (PI)

02/01/15 – 10/31/19

Project Title: Environmental exposures across urban and rural communities in the Deep South

Working with community groups, we will determine whether significant differences in vulnerability to heat-related health impacts exist between underserved urban and rural communities in the Deep South.

ICTAS Diversity Seed Grant (Virginia Tech) Gohlke (PI) 11/01/16 – 6/30/17  
Project Title: Radon Education, Testing, and Mitigation in Rural Communities  
Working with Bluefield State College, we are running educational sessions, recruiting homes for radon testing, and providing mitigation to selected homes with high radon levels in Tazewell Cty, VA and Mercer Cty, WV.

NSF 1605355 Dietrich (PI) 07/01/16 - 06/30/19  
Project Title: Assessing Inhalation Exposure to Aerosolized Contaminants from Drinking Water.  
The project is determining exposure and assessing potential health risks from inhalation of metals from humidifier use.

#### **Selected Recently Completed Research Support**

NIH/NIEHS 1R21ES020205 Gohlke (PI) 08/15/11 – 07/31/2014  
Extreme Heat Events-Evolving risk patterns in urban and rural communities  
This study examined the impacts of heatwaves in urban versus rural communities in Alabama using retrospective analysis of birth and death records and satellite-derived datasets.

EPA/VDH Marmagas(PI) 03/25/16-7/15/16  
Environmental Protection Agency/Virginia Department of Health Contract  
Project title: Home radon testing in Tazewell County, VA  
The goal of this work was to evaluate radon exposure in Tazewell County by randomly recruiting 300 homeowners to conduct home radon testing.

VT GCC Krometis(PI) 01/01/16-09/30/16  
Global Change Center at VT Seed Grant  
Project title: How does environmental landscape change shape community and ecological health in the Central Appalachian Coalfields? A pilot study in Tazewell County, Virginia.  
The goal of this pilot project is to analyze VA vital statistics (birth, death records) for trends in birth weight and primary causes of mortality as it relates to landuse/land cover changes over the past 30 years.

Red Cross Gohlke and Zaitchik (Co-PIs) 09/01/15-02/15/16  
American Red Cross and Red Crescent Climate Center Contract  
Project title: Health impacts of extreme heat in the informal settlements of Nairobi  
The goal of this project was to estimate a threshold temperature that would like increase mortality due to extreme heat exposure in Nairobi via a meta-analysis of studies conducted elsewhere.

NIH/NIOSH 2 T42 OH008436 08 Lungu(PI) 07/01/13 – 6/30/15  
Deep South Occupational Safety and Health Education and Research Center  
Developing professionals who protect and promote the health and safety of workers through interdisciplinary education, research, and outreach programs.

UAB CSCH ROSA Award Gohlke(PI) 09/01/15-08/30/16  
UAB Center for the Study of Community Health Researchers Omnibus Survey of Alabama  
Project Title: An environmental health phone survey of Alabama residents and public health professionals  
The aim of this work is to determine urban and rural environmental health priorities and opportunities and barriers in the development of a statewide environmental health tracking program in Alabama.

UAB ETM pilot Gohlke(PI) 10/01/12 – 09/30/13  
UAB Environmental and Translational Medicine Program  
Project Title: Geospatial analysis of health outcomes in North Birmingham: A spatial time-series analysis of birth and death records (1990-2010) to determine whether living in close proximity to coke facilities.

NIH Fogarty 5 D43 TW05497-09 Sathiakumar(PI) 10/01/12 – 10/30/13  
Project Title: UAB International Training and Research in Environmental and Occupational Health in South East Asia: the Aga Khan University in Karachi, Pakistan; Manipal University (MU) in Manipal, India; and University of Kelaniya (UKe) in Sri Lanka.

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## BIOGRAPHICAL SKETCH

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NAME Kolivras, Korine Nicole	POSITION TITLE Associate Professor of Geography
eRA COMMONS USER NAME (credential, e.g., agency login) KOLIVRAS	

EDUCATION/TRAINING			
INSTITUTION AND LOCATION	DEGREE <i>(if applicable)</i>	MM/YY	FIELD OF STUDY
Shippensburg University, Shippensburg, PA	BA	05/97	Geography
University of Arizona, Tucson, AZ	MA	12/00	Geography
University of Arizona	PhD	08/04	Geography Minor: Epidemiology

### A. Personal Statement

As a broadly-trained health/medical geographer with specific training and expertise in the human health impacts of environmental variability and change using geospatial techniques, I have the expertise and training to contribute to the Global Systems Science destination area concept in rural health. I regularly collaborate with multidisciplinary teams, and during these collaborations, I bring a spatial perspective to address complex problems, as well as the ability to use geospatial techniques to understand, analyze, and visualize the spatial patterns of health concerns, and the underlying processes that contribute to those patterns. As PI on an NSF-funded grant, I worked with an interdisciplinary team of researchers, including geographers, statisticians, an entomologist, and a forestry specialist to examine links between land cover change and the emergence pattern of Lyme disease in Virginia using GIS and remotely-sensed data. We identified specific land cover patterns that are associated with human cases with the use of data at multiple spatial scales. I have a strong commitment to teaching, as evidenced by college and disciplinary national teaching awards, and a proven track record of mentoring graduate students on research projects through the completion of their degrees. This application builds on my training and background, which combines geography and epidemiology, and strengths in interdisciplinary work.

### B. Positions and Honors

#### Positions and Employment

1997-1998	GIS Analyst, Advanced Technology Solutions (now GeographIT), Lancaster, PA
1998-1999	Graduate Teaching Assistant, Department of Geography, University of Arizona, Tucson, AZ
1999-2002	Graduate Research Assistant, Department of Geography, University of Arizona, Tucson, AZ
2002-2004	NASA Space Grant Fellow, University of Arizona, Tucson AZ
2004-2011	Assistant Professor, Department of Geography, Virginia Tech, Blacksburg, VA
2011-	Associate Professor, Department of Geography, Virginia Tech, Blacksburg, VA

#### Other Experience and Professional Memberships

2015-	Treasurer, Southeastern Division of the American Association of Geographers
2013	Invited Speaker, University of North Carolina-Chapel Hill, Department of Geography Colloquium

## Series

- 2010-2012 Board Member, Health and Medical Geography Specialty Group
- 2006-2008 Board Member, Health and Medical Geography Specialty Group
- 2005-2008 Outreach project in collaboration with the Director of the Punta Cana Ecological Foundation in the Dominican Republic on research related to health, housing, and land use in a shantytown.
- 2005-2008 Moderator, World Geography B
- 2004- Reviewer for National Science Foundation, *Annals of the Association of American Geographers*, *Climate Research*, *Environmental Health Perspectives*, *Geography Compass*, *Global Change Biology*, *International Journal of Biometeorology*, *International Journal of Climatology*, *International Journal of Health Geographics*, *Journal of Applied Geography*, *Professional Geographer*, *Singapore Journal of Tropical Geography*, *Southeastern Geographer*, *Social Science & Medicine*
- 1999- Member, American Association of Geographers
- 2005- Member, Southeastern Division of the American Association of Geographers

## Honors

- 2005 Finalist, J. Warren Nystrom Award for Best Paper from a Dissertation in Geography. Association of American Geographers.
- 2006 Curriculum Club Outstanding Teacher, Department of Geography, Virginia Tech.
- 2010 Higher Education Distinguished Teaching Award, National Council for Geographic Education.

## C. Publications

### Most Relevant Journal Articles (selected from n=26)

- Krometis, L.-A., J. Gohlke, **K.N. Kolivras**, E. Satterwhite, S.W. Marmagas, L. Marr. 2017. Environmental health concerns and disparities in the central Appalachian region of the United States. *Reviews on Environmental Health*. Accepted.
- Bandzuh, J.T., L. Juran, **K.N. Kolivras**, A. Wallis. 2017. Local perceptions of measures to control Aedes mosquitoes and mosquito-borne diseases in Puntarenas and San Jose, Costa Rica. *Journal of Latin American Geography*. Accepted.
- Juran, L., J. Trivedi, and **K.N. Kolivras**. 2017. Considering the 'public' in public health: Poplar resistance to the Smallpox Eradication Programme in India. *Indian Journal of Medical Ethics* 2(2): 104-111.
- Hill, J., C.N. Water, **K.N. Kolivras**, P.A. Estabrooks, and J.M. Zoellner. 2016. Do the features, amenities, and quality of physical activity resources differ between city and county areas of a large rural region? *Family & Community Health* 39(4): 273-282.
- Seukep, S.E., **K.N. Kolivras**, Y. Hong, J. Li, S. Prisley, J. Campbell, D. Gaines, R. Dymond. 2015. An examination of the demographic and environmental variables correlated with Lyme disease emergence in Virginia. *EcoHealth* 12(4): 634-644.
- Li, J., **K.N. Kolivras**, Y. Hong, Y. Duan\*, S.E. Seukep\*, S. Prisley, J. Campbell, D. Gaines. 2014. Spatial and Temporal Emergence Pattern of Lyme Disease in Virginia. *American Journal of Tropical Medicine & Hygiene*. 91(6): 1166-1172.
- Khan, M., Bryceson, I., **K. N. Kolivras**, Faruque, F., Rahman, M., and Haque, U. 2014. Natural Disasters and land-use/land-cover change in the southwest coastal areas of Bangladesh. *Regional Environmental Change*. DOI 10.1007/s10113-014-0642-8.
- Haque, U., Hashizume, M., **Kolivras, K.N.**, Overgaard, H. J., Das, B., and Yamamoto, T. 2012. Reduced death rates from cyclones in Bangladesh – What more needs to be done?. *Bulletin of the World Health Organization* 90: 150-156.



**Leigh-Anne Krometis, Ph.D., E.I.T.**

Assistant Professor

Department of Biological Systems Engineering

Virginia Tech

<http://ww2.bse.vt.edu/krometis/>

[krometis@vt.edu](mailto:krometis@vt.edu)

**(a) Professional Preparation**

Virginia Tech	Blacksburg, VA	Biological Systems Engineering	B.S. 2002
Virginia Tech	Blacksburg, VA	Biological Systems Engineering	M.S. 2004
U. of North Carolina	Chapel Hill, NC	Environmental Sci. & Eng.	PhD 2009

**(b) Appointments**

2011-Present	Biological Systems Engineering, Virginia Tech	Assistant Professor
2009-2011	Biological Systems Engineering, Virginia Tech	Research Assistant Professor
2009	Environmental Science & Eng, Univ of NC	Postdoctoral Researcher

**Select Publications (out of 33 total peer-reviewed, H Index=11)**

**i. Five Related Publications**

1. Krometis, L., J. Gohlke, K. Kolivras, E. Satterwhite, S. Marmagas, L. Marr. Environmental Health Disparities in the Central Appalachian Region of the United States. *Reviews on Environmental Health*. **Revisions submitted, April 2017**.
2. Cantor, J., L. Krometis, E. Sarver, N. Cook\*, B. Badgley. Tracking the Downstream Impacts of Inadequate Sanitation in Central Appalachia. *Journal of Water and Health*. **In press, April 2017**.
3. Cook, N., E. Sarver, L. Krometis, J. Huang. Habitat and water quality as drivers of ecological system health in Central Appalachia. *Ecological Engineering*. **2015**, 84: 180-189.
4. Cook, N., L. Krometis, E. Sarver, J. Huang. Inorganic constituents of conductivity in five Central Appalachian watersheds with mixed source-driven pollutants. *Ecological Engineering*. **2015**, 82: 175-183.
5. Smith, T., L. H. Krometis, C. Hagedorn, B. Benham, A. H. Lawrence, E. Ling, P. Ziegler, S. W. Marmagas. Associations between fecal indicator bacteria prevalence and demographic data in private water supplies in Virginia. *Journal of Water and Health*. **2014**, 12(4): 824-834.

**ii. Other Relevant Publications**

1. Pieper, K., L. Krometis, D. Gallagher, B. Benham. Simultaneous influence of geology and system design on drinking water quality in private systems. *Journal of Environmental Health*. **2016**, 79(2): S1-S8.
2. Liao, H., L. Krometis, K. Kline. 2016. Coupling a continuous watershed-scale microbial fate and transport model with a stochastic dose-response model to estimate risk of illness in an urban watershed. *Science of the Total Environment*. **2016**, (551/552): 668-675
3. Pieper, K., L. Krometis, D. Gallagher, B. Benham, M. Edwards. Profiling private water systems to identify patterns of waterborne lead exposure. *Environmental Science and Technology*. **2015**, 49(21): 12697-12704.
4. Liao, H., L. Krometis, C. Hession, R. Benitez, R. Sawyer, E. Schaeberg, E. von Wagoner, B. Badgley. Storm loadings of general and human-specific fecal indicators in an inland urban stream. *Science of the Total Environment*. **2015**, (530/531): 347-356.

5. Krometis, L.H., E. P. Clark, V. Gonzalez, M. E. Leslie. The "death" of disciplines: Development of a team-taught course to provide an interdisciplinary perspective for first-year students. *College Teaching*. **2011**. 59(2): 73-78..

**(d) Synergistic Activities**

- *Co-Director*, NSF StREAM REU (“Dynamics of Water and Societal Systems: An Interdisciplinary Research Program at the Virginia Tech StREAM Lab”), 2012-2014. Co-led summer research program focused on interdisciplinary watershed management; hosted 28 undergraduates from 18 different home institutions representing 18 different disciplinary degrees.
- *Virginia Tech Imagination Camp Faculty Volunteer*, 2010-2014. Designed and led hands-on field and lab-scale activities focused on environmental microbiology and public health for 100 middle-school students participating in a Virginia Tech summer camp.
- *Faculty Member*, Virginia Tech Center for Global Change, 2014-present. (steering committee for Interfaces of Global Change PhD Program, 2014-2015).
- *Team Member and Research Student Advisor*, Cooperative Extension Virginia Household Water Quality Program, 2011-2015. Provides education and low cost water quality testing to homeowners reliant on private water supplies (e.g. wells, springs); program received the Florence Hall Award from the National Extension Association of Family and Consumer Science in May 2013; six resultant peer-reviewed publications led by students.
- *Faculty Fellow*, Virginia Tech Honors Residential Commons, 2010-present. Broad aim is to support the development of interdisciplinary residential colleges that will house and nurture students academically throughout their college career.

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## BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors in the order listed on Form Page 2.  
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

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NAME Susan West Marmagas, MPH		POSITION TITLE Associate Professor of Public Health Practice		
eRA COMMONS USER NAME (credential, e.g., agency login) SMARMAGAS				
EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)				
INSTITUTION AND LOCATION		DEGREE (if applicable)	MM/YY	FIELD OF STUDY
Earlham College		BA	05/1990	International Studies
University of California, Berkeley		MPH	05/1995	Community Health Education

### A. Personal Statement

The goal of the Global Systems Science concept in human and ecological health in rural communities is to establish new, innovative research on environmental health disparities in Appalachia that also engages community partners and builds their literacy while fostering the development of creative researchers in this topic. I have a track record of effectively managing federally-funded programs both during my tenure at Virginia Tech and my prior practice experience in Washington, DC. I hold a “faculty of practice” position (considered a regular faculty position at Virginia Tech) to facilitate my combination of teaching, research and service in the community. I served as the PI for Virginia Tech’s subcontract on the HRSA-funded Commonwealth Public Health Training Center from 2010-14 that created a “Let’s Talk Public Health” youth leadership program in Virginia. I co-created and am currently co-managing Virginia Tech’s MPH program for which I have served as its Assistant Director since its founding in 2010. In this capacity, I have built and managed systems for CEPH accreditation, data management, student recruitment, admissions, retention and graduation, and evaluation and assessment. In current practice, I have either overseen or participated with other practice partners working in the Central Appalachian region on projects related to: understanding community cancer concerns, perceptions of environment and cancer, uptake of vaccinations (seasonal flu and HPV), and community health needs assessments. In Washington, DC I managed a national effort to educate health care providers on children’s environmental health, prevention of pesticide exposures, and mercury and fish consumption. I have also served as a meeting facilitator for an array of global, national and regional meetings including WHO Europe’s Children’s Environmental Health Indicators Meeting, EPA’s Pesticides and Health Care Providers, HRSA National Forum on Nurses and the Environment, and UC Berkeley’s Cumulative Impacts and Communities. I served on the Executive Board of the American Public Health Association and as a member of US EPA’s Children’s Health Protection Advisory Committee. I am a community health educator who has practiced in the environmental health field since 1994. I look forward to combining my leadership experience at the federal level, my grant and personnel management experience, with my preliminary work in the region and my roots in Appalachia.

### B. Positions and Honors

#### Positions and Employment

1994-1995 Health Educator, Children’s Environmental Health Network, Emeryville, CA  
1995-1997 Associate Director, Children’s Environmental Health Network, Emeryville, CA  
1997-2000 Senior Director, Health and Environment Programs, National Environmental Education Foundation, Washington, DC  
2000-2001 Environmental Health Education and Outreach Director, Physicians for Social Responsibility, Washington, DC  
2001-2005 Director, Environment & Health Program, Physicians for Social Responsibility, Washington, DC  
2005-2007 Director, Health Programs, Collaborative on Health and the Environment, Commonweal, Bolinas, CA (based in Washington, DC)

2007-2008 Director, Women's Health and Environment Initiative, Commonweal, Bolinas, CA (based in Blacksburg, VA)

2007-2010 Consultant, Environmental Determinants of Cancer in Appalachia, Appalachia Community Cancer Network, University of Kentucky, Lexington, KY

2008-2010 Research Fellow, Institute for Society, Culture and Environment, Virginia Tech, Blacksburg, VA

2009-present Assistant Director, Public Health Program, Virginia Tech, Blacksburg, VA

2010-present Associate Professor of Public Health Practice, Department of Population Health Sciences, College of Veterinary Medicine, Virginia Tech, Blacksburg, VA

### **Other Experience and Professional Memberships**

1994-present Member, American Public Health Association (APHA)

1996-1999 Co-char, APHA Children's Environmental Health Committee

1999-2002 Instructor, George Washington University, School of Public Health

2000-present Accreditation Site Visitor and Site Visit Chair, Council on Education for Public Health

2000-2001 Facilitator, Series of Regional Workshops on Pesticides, US Environmental Protection Agency

2000-2001 Facilitator, Nursing Workshops, Health Resources and Services Administration

2001-2003 Scholar, National Public Health Leadership Institute

2001-2007 Member, Children's Health Protection Advisory Committee, US Environmental Protection Agency

2003 Facilitator, Workshop on Children's Environmental Health in Europe, World Health Organization, Wroclaw, Poland

2002-2005 Member, APHA Governing Council

2005 Co-facilitator, Workshop on Environmental Policy in the European Union, European Environmental Public Health Association, Brussels, Belgium

2005-2006 Chair, APHA Nominating Committee

2007-present Member, Virginia Public Health Association

2008-2012 Board Member and Western Region Representative, Virginia Public Health Association

2009 Co-facilitator, Children and the Environment: What Have We Learned and What Do We Need to Do? A Multi Sector Research Translation Workshop, Oakland, California

2009 Co-facilitator, Cumulative Impacts in California Communities: A Symposium Sponsored by the University of California, Berkeley

2009-2012 Member, APHA Executive Board

2009-2010 Member, Serving Communities Work Group, National Conversation on Public Health and Chemical Exposures, National Center for Environmental Health (CDC)

2010-2013 Member, Steering Committee, Partnership for Access to Healthcare in the New River Valley

2011 Vice-Chair, APHA Executive Board

2012 Chair, APHA Executive Board

2014-present Member, APHA Science Board and Joint Policy Committee

2015-present Member, Board of Directors, Community Health Center of the New River Valley

### **Honors**

2004 Distinguished Service Award, APHA Environment Section

2006 Broad Street Pump Award, Physicians for Social Responsibility

### **B. Selected relevant peer-reviewed publications**

L.H. Krometis, J.M. Gohlke, K. Kolivras, E. Satterwhite, **S. W. Marmagas**, L. Marr. 2017. Environmental Health Disparities in the Central Appalachian Region of the United States. *Reviews in Environmental Health*. Accepted.

Smith, T., L. H. Krometis, C. Hagedorn, B. Benham, A. H. Lawrence, E. Ling, P. Ziegler, **S. W. Marmagas**. 2014. Associations between fecal indicator bacteria prevalence and demographic data in private water supplies in Virginia. *Journal of Water and Health* 12(4): 824-834.

### **C. Research Support**

ICTAS Diversity Seed Grant (Virginia Tech) 11/01/16 – 6/30/17  
Project Title: Radon Education, Testing, and Mitigation in Rural Communities  
Working with Bluefield State College, we are running educational sessions, recruiting homes for radon testing, and providing mitigation to selected homes with high radon levels in Tazewell Cty, VA and Mercer Cty, WV.

Appalachian Community Cancer Network 5/1/07-8/30/16  
Community Networks Program, Center to Reduce Cancer Health Disparities, National Cancer Institute  
Consultant, Environmental Determinants of Cancer in Appalachia  
Project Manager, Walk by Faith Research Intervention in Giles County, Virginia

EPA/VDH 03/25/16-7/15/16  
Environmental Protection Agency/Virginia Department of Health Contract  
Project title: Home radon testing in Tazewell County, VA  
The goal of this work was to evaluate radon exposure in Tazewell County by randomly recruiting 300 homeowners to conduct home radon testing.

VT GCC 01/01/16-09/30/16  
Global Change Center at VT Seed Grant  
Project title: How does environmental landscape change shape community and ecological health in the Central Appalachian Coalfields? A pilot study in Tazewell County, Virginia.  
The goal of this pilot project is to analyze VA vital statistics (birth, death records) for trends in birth weight and primary causes of mortality as it relates to landuse/land cover changes over the past 30 years.

Tazewell Board of Supervisors 5/1/14-4/30/15  
Co-PI, Tazewell Community Cancer Project

Health Resources and Services Administration 10/1/10-9/30/14  
(subcontract from Eastern Virginia Medical School)  
Commonwealth Public Health Training Center  
PI, Virginia Tech Subcontract

Virginia Department of Health 4/18/11-10/31/11  
Cumberland Plateau Health District (Russell County, Virginia)  
PI, Flu Vaccination Survey: Parental Choices about H1N1 and Seasonal Flu Vaccinations for Children

## BIOGRAPHICAL SKETCH

NAME Marr, Linsey C.		POSITION TITLE Professor of Civil and Environmental Engineering	
eRA COMMONS USER NAME LIMARR			
EDUCATION/TRAINING			
INSTITUTION AND LOCATION	DEGREE (if applicable)	MM/YY	FIELD OF STUDY
Harvard, Cambridge, Massachusetts	B.S.	06/96	Engineering Sciences
University of California at Berkeley	Ph.D.	05/02	Civil and Environmental Engineering
Massachusetts Institute of Technology	Postdoctoral	06/03	Earth, Atmospheric, and Planetary Sciences

### A. Personal Statement

As a premier interdisciplinary researcher, I am at the point in my career where I am poised to provide long-lasting leadership to advance innovative, interdisciplinary research at Virginia Tech and to make rural environmental health a signature strength of the Global Systems Science Destination Area. I previously led a \$5 million proposal to NIH for a Center of Excellence on Environmental Health Disparities on the same topic as the proposed concept. Although the proposal was not funded, our group continues to build toward large grant opportunities and has received support from the Institute for Society, Culture, and Environment and the Global Change Center. I am heavily involved in interdisciplinary research and education across campus, including two Interdisciplinary Graduate Education Programs (Sustainable Nanotechnology and BIOTRANS) and two foci of ICTAS (Nanoscale Science and Engineering and Exposome). I have a demonstrated record of success and productivity, as evidenced by my strong publication history (73 peer-reviewed papers) and citations (>3400, h-index of 27 according to Google Scholar) and record of funding. I have been the PI on seven grants funded by NIH, NSF, or EPA, including an NIH New Innovator award and an NSF CAREER award, and a Co-PI on many others.

### B. Positions and Honors

#### Positions and Employment

1996-2002	Research Assistant, Civil and Environmental Engineering, University of California at Berkeley
2002-2003	Postdoctoral Associate, Earth, Atmospheric, and Planetary Sciences, MIT
2003-2005	Assistant Professor, Civil and Environmental Engineering, Virginia Tech, Blacksburg, VA
2005-2013	Associate Professor, Civil and Environmental Engineering, Virginia Tech, Blacksburg, VA
2013-	Professor, Civil and Environmental Engineering, Virginia Tech, Blacksburg, VA

#### Other Experience and Professional Memberships

2017	Member, National Academy of Sciences Committee on Grand Challenges in Environmental Engineering
2017	Invited speaker, Gordon Research Conference on Environmental Nanotechnology
2016	Invited speaker, National Academy of Sciences Committee on Indoor Microbiomes
2016-	Editorial Advisory Board member for <i>Environmental Science &amp; Technology Letters</i>
2016-	Editorial Advisory Board member for <i>Environmental Science: Processes and Impacts</i>
2015	Invited plenary speaker, American Association for Aerosol Research 34 <sup>th</sup> Annual Conference
2013-2016	Treasurer, American Association for Aerosol Research
2014-	Editorial Advisory Board member for <i>Aerosol Science and Technology</i>
2014	Invited contributor, OECD Expert Meeting on Categorization of Manufactured Nanomaterials
2012	Invited speaker, Sloan Foundation Microbiology of the Built Environment Conference

2012	Invited speaker, NSF Nanoscale Science and Engineering Conference
2012	Invited speaker, American Chemical Society National Meeting, San Diego, CA
2010	Chair, American Association for Aerosol Research Combustion and Nanoparticles Working Group
2006, 2010	Invited participant, NSF Workshop on Indoor Air Chemistry
2003-	Reviewer for California Air Resources Board, Environmental Protection Agency, National Institutes of Health, National Science Foundation, <i>Aerosol Science and Technology</i> , <i>Applied and Environmental Microbiology</i> , <i>Atmospheric Chemistry and Physics</i> , <i>Atmospheric Environment</i> , <i>Atmospheric Research</i> , <i>Environmental Monitoring and Assessment</i> , <i>Environmental Science: Nano</i> , <i>Environmental Science and Policy</i> , <i>Environmental Science and Technology</i> , <i>Global Change Biology</i> , <i>Indoor Air</i> , <i>Journal of Applied Meteorology and Climatology</i> , <i>Journal of Environmental Engineering and Science</i> , <i>Journal of Environmental Informatics</i> , <i>Journal of Geophysical Research</i> , <i>Journal of the Air and Waste Management Association</i> , <i>Journal of the Royal Society Interface</i> , <i>Medicine and Science in Sports and Exercise</i> , <i>Nature Nano</i> , <i>Particle and Fibre Toxicology</i> , <i>PLoS One</i> , <i>Science of the Total Environment</i> , <i>Scientific Reports</i>
2003-2009	Member, Association of Environmental Engineering and Science Professors
2005-	Member, American Association for Aerosol Research

### Honors

1996	National Science Foundation Graduate Research Fellowship
1999	US Environmental Protection Agency STAR Graduate Research Fellowship
1999	Outstanding Graduate Student Instructor, University of California at Berkeley
<b>2006</b>	<b>National Science Foundation CAREER award</b>
2006	Virginia Tech College of Engineering Outstanding New Assistant Professor
2007	Virginia Tech College of Engineering Faculty Fellow
2010	Civil and Environmental Engineering Alumni Board Teaching Excellence Award
<b>2013</b>	<b>NIH Director's New Innovator Award</b>
2014	Virginia Tech College of Engineering Dean's Award for Excellence in Research
2014	Virginia Tech Innovator Award
2017	Fulbright Scholar

### **C. Contribution to Science**

**1. Role of aerosolized pathogens in transmission of infectious disease.** Despite tremendous advances in medicine and technology in recent decades, infectious diseases remain a major threat to public health, and our understanding of transmission mechanisms remains primitive. My publications have shown that airborne transmission of influenza is indeed feasible and reveal mechanisms for the seasonality of influenza. Low indoor humidity during the wintertime in temperate regions affects the size and fate of respiratory aerosols, and varying degrees of evaporation of the aerosols affect the pathogen's microenvironment and its viability. Expanding beyond influenza, we are currently studying the airborne microbiome in indoor environments.

- a. Lin, K., Marr, L.C., (2017). Aerosolization of Ebola virus surrogates in wastewater systems, *Environmental Science and Technology*, 51, 2669–2675.
- b. Prussin II, A.J., Marr, L.C., (2015). Sources of airborne microorganisms in the built environment, *Microbiome*, 3, Art. no. 78.
- c. Prussin II, A.J., Garcia, E.B., Marr, L.C., (2015). Total concentrations of virus and bacteria in indoor and outdoor air, *Environmental Science and Technology Letters*, 2, 84-88.
- d. Yang, W., Elankumaran, S., Marr, L.C., (2011). Concentrations and size distributions of airborne influenza A viruses measured indoors at a health centre, a day-care centre and on aeroplanes, *Journal of the Royal Society Interface*, 8, 1176-1184.

**2. Exposure to air pollutants.** Exposure assessment is a key step in risk characterization, and I have measured exposure to various air toxics and pollutants of emerging concern. My publications have defined exposure levels to diesel exhaust, including polycyclic aromatic hydrocarbons, in the workplace and to

engineered nanomaterials in realistic scenarios involving the use of nanotechnology-based consumer products. I have collaborated with the US Environmental Protection Agency and the Consumer Products Safety Commission on some of this research.

- a. Xie, M., Wu, Y., Little, J.C., Marr, L.C., (2016). Phthalates and alternative plasticizers and potential for contact exposure from children's backpacks and toys, *Journal of Exposure Analysis and Environmental Epidemiology*, 26, 119-24.
- b. Vance, M.E., Marr, L.C., (2015). Exposure to airborne engineered nanoparticles in the indoor environment, *Atmospheric Environment*, 106, 503-509.
- c. Sheesley, R.J., Schauer, J.J., Smith, T.J., Garshick, E., Laden, F., Marr, L.C., Molina, L.T., (2008). Assessment of diesel particulate matter exposure in the workplace: freight terminals, *Journal of Environmental Monitoring*, 10, 305-314.
- d. Marr, L.C., Grogan, L.A., Wohrnschimmel, H., Molina, L.T., Molina, M.J., Smith, T.J., Garshick, E., (2004). Vehicle traffic as a source of particulate polycyclic aromatic hydrocarbon exposure in the Mexico City Metropolitan Area, *Environmental Science and Technology*, 38, 2584-2592.

**3. Sources of airborne engineered nanomaterials.** Nanomaterials are inevitably released into the indoor and outdoor atmosphere. Prediction of their health and environmental impacts requires detailed characterization of their physical and chemical properties. My publications have shown that nanomaterials are released during production, use, and disposal and have quantified them not just in terms of exposure but also in terms of emission factors, which enable others to use these results to estimate emissions from similar processes. In addition to characterizing the nanomaterials themselves, my research group has also shown that their presence during combustion can affect releases of other toxic byproducts, such as dioxins and polycyclic aromatic hydrocarbons. The US Environmental Protection Agency has used our results to guide its policymaking surrounding nanotechnology.

- a. Tiwari, A.J., Ashraf-Khorassani, M., Marr, L.C., (2016). C<sub>60</sub> fullerenes from combustion of common fuels, *Science of the Total Environment*, 547, 254-60.
- b. Vejerano, E.P., Leon, E.C., Holder, A.L., Marr, L.C., (2014). Characterization of particle emissions and fate of nanomaterials during incineration, *Environmental Science: Nano*, 1, 133-143.
- c. Vejerano, E.P., Holder, A.L., Marr, L.C., (2013). Emissions of polycyclic aromatic hydrocarbons, polychlorinated dibenzo-p-dioxins, and dibenzofurans from incineration of nanomaterials, *Environmental Science and Technology*, 47, 4866-4874.
- d. Quadros, M.E., Marr, L.C., (2011). Silver nanoparticles and total aerosols emitted by nanotechnology-related consumer spray products, *Environmental Science and Technology*, 45, 10713-10719.

**4. Transportation-related air pollutant emissions.** Accurate estimates of emissions are critical for effective air quality management, and the transportation sector is one of the largest sources of air pollutant emissions. Employing various techniques to study emissions under real-world conditions, I have quantified organic compounds, nitrogen oxides, carbon monoxide, particulate matter mass and number, particle-bound polycyclic aromatic hydrocarbons, and black carbon emitted by various transportation-related sources, including motor vehicles, construction equipment, and aircraft. These results have helped explain discrepancies between ambient observations and laboratory-based studies of emissions and have contributed to improved understanding of air quality by scientists and policy-makers.

- a. Hong, A., Schweitzer, L., Yang, W., Marr, L.C., (2015). The impact of temporary freeway closure on regional air quality: A lesson from Carmageddon in Los Angeles, United States, *Environmental Science and Technology*, 5, 3211-3218. (*ES&T is considered the top journal in environmental engineering and has an impact factor of 5.48.*)
- b. Heidari, B., Marr, L.C., (2015). Real-time emissions from construction equipment compared with model predictions, *Journal of the Air and Waste Management Association*, 65, 115-125.
- c. Marr, L.C., Moore, T.O., Klappmeyer, M.E., Killar, M.B., (2013). Comparison of NO<sub>x</sub> fluxes measured by eddy covariance to emission inventories and land use, *Environmental Science and Technology*, 47, 1800-1808.

- d. Klappmeyer, M.E., Marr, L.C., (2012). CO<sub>2</sub>, NO<sub>x</sub>, and particle emissions from aircraft and support activities at a regional airport, *Environmental Science and Technology*, 46, 10974-10981.

## D. Research Support

### Ongoing Research Support

- NIH DP2-AI112243 Marr (PI) 9/1/2013-7/30/2018  
The Role of Pathogen-Environment Interactions in the Pandemic Potential of Influenza  
The goal of this project is to identify the relationship between influenza virus viability in aerosols and relative humidity and to determine the mechanisms that control the relationship.  
Role: PI
- NSF CBET-1438103 Marr (PI) 8/15/2014-8/14/2017  
Solving the Mystery of Humidity's Effect on Viability of Airborne Microorganisms  
The goal of this project is to determine the relationship between the viability of aerosolized bacteria and viruses and ambient environmental conditions.  
Role: PI
- US Army Research Office W911NF-16-1-0007 Marr (PI) 11/1/2015-10/31/2018  
The Effect of Humidity and Particle Composition on Partitioning of Volatile Organic Compounds  
The goal of this project is to measure gas-aerosol-soil partitioning of certain VOCs that are widely used as solvents, degreasers, or pesticides as a function of temperature, relative humidity, soil textural class, and particle chemical composition.  
Role: PI
- Virginia DEQ Marr (PI) 10/30/2013-10/29/2016  
Air Quality Modeling System Services (AQMSS)  
The goal of this project is to provide high-performance computing hardware and support for air quality modelers at the state environmental agency.  
Role: PI
- NSF CBET- 1605355 Dietrich (PI) 7/1/2016-6/30/2019  
Assessing Inhalation Exposure to Aerosolized Contaminants from Drinking Water  
This project fills a critical knowledge gap concerning human exposure, at the air-water-human interface, to contaminants from aerosols emitted by ultrasonic humidifiers  
Role: Co-PI
- EPA 83560601 Little (PI) 7/1/2014-6/30/2017  
Rapid Methods to Estimate SVOC Exposure  
The goal of this project is to develop rapid methods to estimate exposure to semi-volatile organic compounds (SVOC) using both a source-oriented approach and a measurement-based approach.  
Role: Co-PI
- NSF EF-0830093 Wiesner (PI) 10/1/2009-9/30/2019  
Center for the Environmental Implications of Nanotechnology  
The goal of this project is to assess the environmental fate and transport and risks posed by engineered nanomaterials.  
Role: Core Faculty
- NSF ECCS- 1542100 Hochella (PI) 9/15/2015-8/31/2020  
NNCI: The Virginia Tech National Center for Earth and Environmental Nanotechnology Infrastructure (VT NCE<sup>2</sup>NI)  
Virginia Tech is a site in NSF's national network of nanotechnology facilities that specializes in supporting researchers who work with nanoscience- and nanotechnology-related aspects of environmental sciences and engineering.  
Role: Co-PI

## **Completed Research Support**

NSF CBET- 1509493

Marr (PI)

1/8/2015-12/31/2016

RAPID: The Role of Aerosolization from Wastewater Systems in the Fate and Transport of and Exposure to Ebola Virus

The overall goal of this research is to assess the potential for inhalation exposure to Ebola virus that is aerosolized during the regular operation and maintenance of wastewater systems.

Role: PI

Water Environment Research Foundation 2C15 Marr (PI)

3/1/2015-8/31/2016

Potential for Exposure to Ebola Virus Surrogates Aerosolized from Wastewater Systems

The overall goal of this research is to assess the potential for inhalation exposure to Ebola virus that is aerosolized during the regular operation and maintenance of wastewater systems.

Role: PI

EPA 83485601-0

Marr (PI)

2/1/2011-1/31/2015

Transformation and Fate of Nanomaterials During Wastewater Treatment and Incineration

The goal of this project was to characterize the transformation, fate, and toxicity of engineered nanomaterials and co-pollutants during biological wastewater treatment and incineration.

Role: PI

NIH R21-OH010330

Agah (PI)

7/1/2012-6/30/2014

A Miniaturized GC with MEMS-Enabled Selective Preconcentration for Monitoring Exposure to Transportation-Related Air Pollutants

The goal of this project was to develop a smart, portable gas analyzer that can be used to measure hazardous air pollutants in (near) real-time in transportation-related and other workplaces.

Role: Co-PI

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## BIOGRAPHICAL SKETCH

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NAME Emily Satterwhite	POSITION TITLE Associate Professor of Appalachian Studies Department of Religion and Culture
eRA COMMONS USER NAME (credential, e.g., agency login) ESATTER	

EDUCATION/TRAINING			
INSTITUTION AND LOCATION	DEGREE <i>(if applicable)</i>	MM/YY	FIELD OF STUDY
Transylvania University	BA	05/94	English, Women's Studies
Emory University, Atlanta, Georgia	MA	05/02	American Studies, Appalachian Studies
Emory University, Atlanta, Georgia	PhD	08/05	American Studies, Appalachian Studies

### A. Personal Statement

For the Global Systems Science destination area concept in rural health, my contributions include expertise in Appalachian history and contexts, cultural sensitivity and inclusion, and humanistic methodologies. Since 2012, I have worked collaboratively across the university to devise interdisciplinary research projects that depend upon successful academic-community collaborations in Appalachian counties. I have a record of award-winning research, with recognitions from within the field of Appalachian Studies (the Weatherford Award for best non-fiction book of 2011) and beyond (the Sturm Award for a book that makes interdisciplinary scholarly research accessible to a broader public audience). Previously, I published peer-reviewed articles based on oral histories, interviews, and participant-observation at the Smithsonian Folklife Festival's Appalachia: Heritage and Harmony exhibition. Recently, my collaborative publications address Appalachian health and environment. I serve as a scholarly consultant to documentary filmmakers addressing the history and politics of representing Appalachia in U.S. popular culture. The current application builds logically on my prior work by extending my passions for expanding Appalachian self-determination and remediating socioeconomic and geographic disparities. Furthermore, given my strong commitment to teaching and my development of the Appalachian Cultures and Environments Pathways Minor, I have the motivation and skills to contribute to curriculum initiatives.

### B. Positions and Honors

#### Positions and Employment

2001-2004	Teaching Associate	Emory University	Graduate Institute of the Liberal Arts (ILA)
2005-2012	Assistant Professor	Virginia Tech	Department of Interdisciplinary Studies (renamed Department of Religion and Culture)
2012-	Associate Professor	Virginia Tech	Department of Religion and Culture

#### Other Experience and Professional Memberships

2015-2017	Program Chair and Steering Committee Member, Appalachian Studies Association
2016	Invited speaker "Women and Culture in Appalachia," King University
2016	Manuscript reviews, University of Georgia Press and University Press of Kentucky
2016	Invited speaker on Appalachian history and culture, Mandela Fellows, Virginia Tech
2015	Invited speaker, Appalachians Fighting on Film, University of Kentucky
2015	Invited speaker, Appalachian cultural competency, Departments of Psychology and Human Development
2014-	Consultant to producers/directors Ashley York and Sally Rubio, <i>Hollywood Hillbilly</i> documentary

- 2014 Invited speaker, Transforming New South Identities Symposium, Center for the Study of Southern Culture, University of Mississippi, Oxford
- 2014 Invited speaker, International Crime, Media and Popular Culture Studies Conference
- 2013 Invited speaker, The Buechner Institute at King University and Virginia Intermont College
- 2012 Invited speaker, "Appalachia and the University," Virginia Military Institute
- 2012 Consultant, NEH grant proposal, Appalachian Media Institute, Appalshop
- 2011- Editorial Advisory Board, Place Matters series, ed. Dwight Billings, Univ. Press of Kentucky
- 2010-2015 Manuscript reviews, *Journal of Appalachian Studies*, Univ. of Illinois Press, *The Register of the Kentucky Historical Society*, Ashgate Publishing, *Journal of American Studies*
- 2006- Editorial Board Member, *Reception: Texts, Readers, Audiences, History*, and Executive Committee, Reception Studies Society
- 2005- Editorial Reviewer, *Southern Spaces*
- 2001-2003 Editor, *Encyclopedia of Appalachia* (University of Tennessee Press, 2006)
- 1999- Member, Appalachian Studies Association

### **Honors**

- 2014 Award for Excellence in Research and Creative Scholarship, College of the Liberal Arts and Human Sciences, Virginia Tech
- 2013 Phi Beta Kappa Albert Lee Sturm Award for Faculty Excellence in Research, for *Dear Appalachia* (2011), Mu Chapter, Virginia Tech
- 2012 Scholar of the Week, Office of the Vice President for Research, Virginia Tech
- 2012 Weatherford Award for best non-fiction book of 2011, Appalachian Studies Association and Berea College Loyal Jones Appalachian Center
- 2012 Certificate of Teaching Excellence, College of Liberal Arts and Human Sciences (CLAHS), Virginia Tech
- 2009 Teacher Recognition Award, selected by Steger Poetry Prize winner, Virginia Tech

### **C. Publications**

#### **Book**

Satterwhite, *Dear Appalachia: Readers, Identity, and Popular Fiction since 1878* (Lexington: University Press of Kentucky, 2011).

#### **Journal Articles**

- Leigh-Anne Krometis, Julia Gohlke, Korine Kolivras, Emily Satterwhite, Susan West Marmagas, Linsey Marr, "Environmental Health Concerns and Disparities in the Central Appalachian Region of the United States," *Reviews on Environmental Health*, accepted with slight revisions April 2017, 15 manuscript pages.
- Lara Moody, Emily Satterwhite, and Warren Bickell, "Substance Use and Treatment Considerations in Rural Appalachia," *Journal of Rural Mental Health* (accepted March 2017).
- "Objecting to Insider/Outsider Politics and the Uncritical Celebration of Appalachia," *Appalachian Journal* 38:1 (Fall 2010): 68-73.
- "Imagining Home, Nation, World: Appalachia on the Mall," *Journal of American Folklore* 121:479 (Winter 2008): 10-34.
- "Reading Craddock, Reading Murfree: Local Color, Authenticity, and Geographies of Reception," *American Literature* 78:1 (March 2006): 59-88.
- "That's What They're All Singing About': Appalachian Heritage, Celtic Pride, and American Nationalism at the 2003 Smithsonian Folklife Festival," *Appalachian Journal* 32:3 (Spring 2005): 302-338.

#### **Book Chapters (selected, four of seven)**

"The Politics of Hillbilly Horror." 6,000-word manuscript. *Navigating Souths: Transdisciplinary Explorations of a US Region*, eds. Michele Coffey and Jodi Skipper (U of Georgia Press, New Southern Studies Series, in press for publication in 2017).

Foreword, *Post-9/11 Heartland Horror: Rural Horror Films in an Era of Urban Terrorism*, Victoria McCollum (Ashgate, 2016): ix-xi.

“Appalachia and the University,” in “Finding Our Place: Region, Identity, and Education” Symposium, *Studies in American Culture* 36:1 (October 2013): 16-22.

“Intro to Appalachian Studies: Navigating the Myths of Appalachian Exceptionalism,” in Patricia M. Gantt and Theresa L. Burriss, eds., *Appalachia in the Classroom: Teaching the Region* (Ohio University Press, Series in Race, Ethnicity, and Gender in Appalachia, 2013): 3-32.

### Additional Projects and Publications

“Talking About Work: Oral Histories of People Living and Working in Montgomery County, Virginia,” Special Collections, Newman Library, Virginia Tech. Materials from seventy-three interviews conducted by students in my Introduction to American Studies course from 2006 to 2011. Published in the institutional repository, <http://vtechworks.lib.vt.edu/handle/10919/47102>, 2014.

### D. Research Support

VT GCC and ISCE Global Change Center at VT Seed Grant Project title: How does environmental landscape change shape community and ecological health in the Central Appalachian Coalfields? A pilot study in Tazewell County, Virginia. The goal of this pilot project is to analyze oral history interviews and VA vital statistics (birth, death records) for trends in primary causes of mortality as it relates to landuse/land cover changes over the past 30 years.	Krometis(PI)	01/01/16-09/30/16
VT ISCE Summer Scholars Grant Project title: Parental emotion socialization in Appalachia: Linguistic markers of cultural tension in Tazewell County, Virginia	Carmichael(PI)	06/01/16-08/30/16
VT ISCE Seed Grant Project title: Piloting “Tuning in to Kids” program, Tazewell County, Virginia	Dunsmore(PI)	06/01/16-08/30/16
VT ISCE Course Buyout Grant Project title: Environmental Health Concerns and Disparities in the Central Appalachian Region of the United States	Satterwhite(PI)	01/01/16-05/30/16
VT South Atlantic Humanities Center and Niles Project title: Talking About Work, Montgomery County, Virginia, oral history digitalization project	Satterwhite(PI)	06/01/12-09/01/12
VT South Atlantic Humanities Center Manuscript Subvention Project title: <i>Dear Appalachia: Readers, Identity, and Popular Fiction Since 1878</i>	Satterwhite(PI)	10/27/09
NEH and Appalachian Studies Assoc. Post-doctoral Research Fellowship for the Study of Race, Gender, and Ethnicity Project title: <i>Dear Appalachia: Readers, Identity, and Popular Fiction Since 1878</i>	Satterwhite(PI)	06/01/09-09/01/09
VT CLAHS Humanities Summer Stipend Project title: <i>Dear Appalachia: Readers, Identity, and Popular Fiction Since 1878</i>	Satterwhite(PI)	06/01/07-09/01/07
VT South Atlantic Humanities Center Research Grant	Satterwhite(PI)	06/01/06-09/01/06

Project title: *Dear Appalachia: Readers, Identity, and Popular Fiction Since 1878*

### **E. Teaching and Curriculum**

Co-coordinator, Appalachian Cultures and Environments Pathways Minor, 2014-present.

Coordinator, Popular Culture Minor, fall 2009-present.

Coordinator, American Studies Minor, Virginia Tech, spring 2006-present.

The Scottish Enlightenment Project, dir. Rachel Chavkin of TEAM (New York City theater company) with partner National Theatre of Scotland. Contributing organizer to residency with VT School of Performing Arts. Fall 2014-spring 2016.

New Program Development Grant, with Rebecca Hester (STS), for possible Dominican Republic program, Global Education Office, Virginia Tech, awarded May 6, 2016 (\$1,820 to Satterwhite).

Pathways Summer Institute, Virginia Tech, June 13-15, 2016.

Pathways Curriculum Grant, \$5,000, awarded March 2016.

Curriculum Globalization Grant, with Rebecca Hester (STS), for the creation of "Societal Health in Local and Global Contexts," \$5,000, Global Education Office, Virginia Tech, awarded February 29, 2016 (\$1,974.50 to Satterwhite).

Senior Fellow, Honey-Locust House, 2012-2015, Holly House, 2015-2016, Residential College at West Ambler Johnston, Virginia Tech.

Summer Faculty Fellow Grant, \$3,500, for curriculum development during summer 2008, IDST 3114: Consumer Culture (capstone course for the American studies minor), Center for Excellence in Undergraduate Teaching (CEUT), Virginia Tech, awarded November 2007.

South Atlantic Humanities Center Fellowship, \$4,000, Spring 2007 course release for curriculum development, HUM 3024: Migrating Cultures in the U.S. South and Caribbean, Virginia Tech, awarded May 2006.

## Abbreviated Vitae of Paul L. Angermeier

**Current position (since 2006):** Research Scientist (GS-15), US Geological Survey, Cooperative Fish and Wildlife Research Unit; Professor, Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA 24061-0321  
Telephone: (540) 231-4501 Fax: (540) 231-7580 Email: [biota@vt.edu](mailto:biota@vt.edu)

**Previous position (1996 - 2006):** Research Scientist, US Geological Survey, Cooperative Fish and Wildlife Research Unit; Associate Professor, Department of Fisheries and Wildlife Sciences, Virginia Tech.

**Education:** BS Purdue University, Environmental Science, 1975  
MS University of Illinois, Ecology, 1979; PhD University of Illinois, Ecology, 1983

### Team Teaching Experience at Virginia Tech (since 2007):

- 2007 – 2011 - Constructing Sustainability
- 2007 - Fish Ecology
- 2013 – 2014 - Biodiversity Conservation & Environmental Sustainability

### Selected Professional service (since 2007):

- Editorial Board, *Freshwater Biology*, 1997-present
- Editorial Board, *Conservation Biology*, 2000-present
- USGS-USFS workgroup to examine effects of climate change on freshwater fish assemblages and ecosystem services, 2011-2012
- American Fisheries Society liaison to Society for Conservation Biology, 2007-present

### Selected Awards (since 2006):

- U. S. Geological Survey Cooperative Research Unit Outstanding Science Award (co-recipient), 2007
- U. S. Department of the Interior Star Award for superior annual performance, 2008

### Selected Grants as Principal or Co-principal Investigator (out of 22 since 2013):

- Development and assessment of tools for evaluating stream and watershed responses to climate change along thermal gradients. United States Forest Service. \$70,000.
- Regulating services as measures of ecological resilience on DoD lands. United States Department of Defense. \$308,359.
- Comparison of habitat suitability among sites supporting strong, localized, and extirpated populations of candy darters (*Etheostoma osburni*). Virginia Department of Game and Inland Fisheries. \$12,500.
- Evaluating air-water temperature linkages in Shenandoah National Park streams. United States Geological Survey. \$75,191.
- Assessing post-construction impacts of the Roanoke River Flood Reduction Project on the endangered Roanoke logperch. United States Army Corps of Engineers. \$254,453.
- Population viability analysis for Roanoke logperch. United States Fish and Wildlife Service. \$17,710.

Assessment of apparent survival and abundance of Roanoke logperch in response to short-term changes in river flow. Virginia Department of Game and Inland Fisheries. \$21,000.

Development and application of a multiscale model of habitat suitability for Roanoke logperch. Virginia Department of Game and Inland Fisheries. \$19,000.

Cost-effectiveness of riparian restoration as a recovery tactic for Roanoke logperch. Virginia Department of Game and Inland Fisheries. \$20,000.

Phenology and habitat use of larval darters in the upper Roanoke River basin. Virginia Department of Game and Inland Fisheries. \$38,000.

Impact of mining effluent on fish populations. Appalachian Research Initiative for Environmental Science. \$50,000.

Demographic status and population genetic differentiation of candy darter populations in Virginia. Virginia Department of Game and Inland Fisheries. \$98,000.

Relating fine sediment dynamics and best management practices (BMPs) to instream habitat conditions for priority fishes and mussels in the Copper Creek drainage. Virginia Department of Game and Inland Fisheries. \$50,000.

How does current management of water quality align with ecological health and human well-being? A preliminary study of Virginia. Virginia Tech Global Change Center. \$23,750.

**Selected refereed publications since 2013 (out of >125 total):**

Lapointe, N.W.R., J. S. Odenkirk, and P.L. Angermeier. 2013. Seasonal movement, dispersal, and home range of Northern Snakehead *Channa argus* (Actinopterygii, Perciformes) in the Potomac River catchment. *Hydrobiologia* 709: 73-87.

Roberts, J.H., P.L. Angermeier, and E.M. Hallerman. 2013. Distance, dams and drift: What structures populations of an endangered, benthic stream fish? *Freshwater Biology* 58: 2050-2064.

Villamagna, A.M., P.L. Angermeier, and E.M. Bennett. 2013. Capacity, pressure, demand, and flow: a conceptual framework for analyzing ecosystem service provision and delivery. *Ecological Complexity* 15: 114-121.

Villamagna, A.M., B. Mogollon, and P.L. Angermeier. 2014. A multi-indicator framework for mapping cultural ecosystem services: the case of freshwater recreational fishing. *Ecological Indicators* 45: 255-265.

Closs, G.P., P.L. Angermeier, W.R.T. Darwall, and S.R. Balcombe. 2015. Why are freshwater fish so threatened? Pages 37-75 in G.P. Closs, M. Krkosek, and J. Olden, (eds.) *Conservation of Freshwater Fishes*. Cambridge University Press.

Villamagna, A.M. and P.L. Angermeier. 2015. A methodology for measuring and mapping ecosystem services provided by watersheds. Pages 151-180 in L. Chícharo, F. Muller, N. Fohrer, and E. Wolanski (eds.), *Ecosystem Services and River Basin Ecohydrology*, Springer.

Howeth, J.G., C.A. Gantz, P.L. Angermeier, E. A. Frimpong, M. H. Hoff, R.P. Keller, N.E. Mandrak,

M.P. Marchetti, J.D. Olden, C.M. Romagosa, and D.M. Lodge. 2016. Predicting invasiveness of species in trade: climate match, trophic guild, and fecundity influence establishment and impact of non-native freshwater fishes. *Diversity and Distributions* 22: 148–160.

Jachowski, D.S., J.J. Millsbaugh, P.L. Angermeier, and R. Slotow, editors. 2016. Reintroduction of fish and wildlife populations. University of California Press.

Lapointe, N.W.R., P.L. Fuller, M. Neilson, B.R. Murphy, and P.L. Angermeier. 2016. Pathways of fish invasions in the Mid-Atlantic region of the United States. *Management of Biological Invasions* 7: in press.

Mogollón, B., E. Frimpong, A. Hoegh, and P.L. Angermeier. 2016. An empirical assessment of which inland floods can be managed? *Journal of Environmental Management* 167: 38-48.

Mogollón, B., A.M. Villamagna, E.A. Frimpong, and P.L. Angermeier. 2016. Mapping technological and biophysical capacities of watersheds to regulate floods. *Ecological Indicators* 16: 483-499.

Roberts, J.H., G.B. Anderson, and P.L. Angermeier. 2016. A long-term study of ecological impacts of a flood reduction project to an endangered riverine fish: lessons learned for assessment and restoration. *Water* 8, 240; doi:10.3390/w8060240.

Roberts, J.H., P.L. Angermeier, and G.B. Anderson. 2016. Population viability analysis for endangered Roanoke logperch. *Journal of Fish and Wildlife Management* 7:46-64.

Roberts, J.H., P.L. Angermeier, and E.M. Hallerman. 2016. Extensive dispersal of Roanoke logperch (*Percina rex*) inferred from genetic marker data. *Ecology of Freshwater Fish* 25: 1-16.

Villamagna, A.M., B. Mogollon, and P.L. Angermeier. 2017. Equity in delivery of ecosystem services: socioeconomic gaps in our public-private conservation network. *Ecology and Society* 22 (1):36 [online] <http://www.ecologyandsociety.org/vol22/iss1/art36/>.

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## BIOGRAPHICAL SKETCH

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NAME: Susan F. Clark

eRA COMMONS USER NAME (credential, e.g., agency login): clark55

POSITION TITLE: Associate Professor of Horticulture and Director, Civic Agriculture and Food Systems

EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.*)

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
Virginia Polytechnic Institute & State University	B.S.	6/77	Human Nutrition & Foods
University of Kentucky	M.S.	8/78	Clinical Nutrition
Virginia Polytechnic Institute & State University	Ph.D.	12/90	Human Nutrition & Foods
Commission on Dietetics Accreditation	R.D.	6/79	Registered Dietitian

### A. Personal Statement

I have the expertise, leadership, training, and motivation necessary to carry out the proposed research and interdisciplinary curriculum development and assessment. My broad background in human nutrition and biochemistry, sustainable or civic agriculture and foods systems along with expertise in pedagogy and curriculum design and assessment, collective impact, collaborative decision-making, community based participatory research (CBPR), ethnographic and survey research align with the proposed project. My recent research scholarship includes qualitative data analysis on the complexities inherent within agri-food systems specific to community food security within rural Appalachia Virginia, North Carolina and West Virginia. My other scholarship also includes assessment of student learning in the sustainable agriculture and food systems curriculum. As PI or co-Investigator on several university and USDA-NIFA-AFRI-funded grants, I have developed interdisciplinary, experiential-based sustainable agriculture and food systems curriculum, and developed methodology for community-based food security assessments. By using a collaborative decision-making governance framework, we engaged and built relationships and trust with diverse community stakeholders, which allowed us to recruit, and track participants over time. In addition, I have successfully administered many interdisciplinary projects (e.g. staffing, research protections, budget), collaborated with other researchers, and produced peer-reviewed publications from each project. Given these previous experiences, I value the importance of developing effective communication among project members and of cultivating collaborative governance and decision-making processes to ensure successful management of any research and curriculum plan, timeline, and budget. The current proposal builds logically on my prior work through the lens of holistic systems thinking related to agriculture and food to effectively navigate complexity and address the world's most pressing, critical problems that are facing agriculture and food through effective transdisciplinary engagement. Several publications resulting from my most recent funding follow.

1. Niewolny K, Moreno-Schroder M, Mason G, McWhirt A, Clark S. (2017). Participatory Praxis for Community Food Security: A Community-Student Engaged Approach to Graduate Education, *Journal of Agriculture, Food Systems and Community Development* (under review 2017).
2. Appalachian Foodshed Project Regional Report Community Food Security (2017) [www.appalachianfoodshed.org](http://www.appalachianfoodshed.org).
3. Appalachian Virginia Community Food Security Assessment, Final Report (2016) [www.appalachianfoodshed.org](http://www.appalachianfoodshed.org).
4. Clark SF, Byker CB, Niewolny K, and Helms J. (2013). Framing an Undergraduate Minor through the Civic Agriculture and Food Systems Curriculum, *North American Teachers and Colleges of Agriculture*, 57(2): 56-67.

## B. Positions and Honors

### Positions and Employment

- 2005 – Associate Professor/Director, Civic Agriculture and Food Systems, Department of Horticulture and  
2005-12 Dietetics Director, Human Nutrition, Foods and Exercise, Virginia Tech, Blacksburg, VA  
1996-2005 Associate Professor, Graduate Dietetic Internship Coordinator, Radford University, Radford, VA  
1995- Instructor, Department of Human Nutrition, Foods and Exercise, Virginia Tech, Blacksburg, VA  
1991-94 Assistant Professor, Department of Biology/Chemistry, Hollins College, Roanoke, VA  
1991 Instructor, Department of Chemistry, Roanoke College, Salem, Virginia  
1981-84 Clinical Research Faculty, Department of Surgery, University of Michigan Medical School, Ann  
Arbor, Michigan  
1979-84 Clinical Instructor, Department of Clinical Nutrition, University of Kentucky, Lexington, Kentucky

### Other Experience and Professional Memberships

- 1979 – Member, Academy Nutrition and Dietetic (AND)  
1990 – Member, Academy Nutrition and Dietetic – Hunger & Environmental Nutrition Practice Group  
2005 – Member, North America Colleges and Teachers of Agriculture and Journal Reviewer  
2010 –12 USDA Higher Education Challenge Grant Peer Review Committee  
2010 – Member, Agriculture, Food, and Human Values Society  
2010 – Member, Sustainable Agricultural Education Association  
2015 – Executive Board Member, Local Education Agriculture Project, Roanoke, VA; 2014-present

### Honors

- 2009–10 Favorite Faculty Award, Virginia Tech, Blacksburg, VA  
2010 Research Scholar of the Week, Virginia Tech Office of Vice President, Research, Blacksburg, VA  
2010 Agriculture Women of the Year, Sigma Alpha, Pi Chapter, Virginia Tech, Blacksburg, VA  
2011 Scholar of the Week, Virginia Tech, Office of International Affairs and Outreach. Blacksburg, VA  
2011 University Exemplary Award, Virginia Tech, CIDER. Blacksburg, VA  
2012 Virginia Tech's University Nominee, U.S. Professor of the Year  
2012 Woman in International Development Award, Heifer International  
2015-16 Beyond Boundaries. Student Working Group, Virginia Tech, Blacksburg, VA  
2015 – Sustainability Institute Fellow, Virginia Tech  
2015 –17 Pathways Scholar, Pathways for General Education, Virginia Tech, Blacksburg, VA  
2017 Teacher of the Week, Virginia Tech, Blacksburg, VA

## C. Contributions to Science (*Recent Relevant Selections*)

1. Niewolny K, Moreno-Schroder M, Mason G, McWhirt A, Clark S. (2017). Participatory Praxis for Community Food Security: A Community-Student Engaged Approach to Graduate Education, *Journal of Agriculture, Food Systems and Community Development* (under review 2017).
2. Helms J, Niewolny K, Clark S, McConnell K, & Friedel C. (2016). Learning through Collaboration and Interdisciplinary Teaching: A Case Study of Faculty Work as Learning in Sustainable Agriculture Education, *North American Teachers and Colleges of Agriculture* 60(2): 219-226.
3. Andress E and Clark S. (2015) Canning Clubs and Community Gardens in *Remaking Home Economics: Resourcefulness and Innovation in Changing Time*. Editors, Sharon Y. Nickols and Gwen Kay; Georgia Press.
4. Byker CB, Serrano E, Clark S. (2014). A Head Start Farm to Family Pilot Program Increased Fruit and Vegetable Intake among Families. *Journal of Human Sciences and Extension* 2(1):37-50.
5. Bryant L, Niewolny K, Clark S, and Watson C. (2014). Complicated Spaces: Negotiating collaborative teaching and interdisciplinarity in higher education, *The Journal of Effective Teaching*; 14(2): 83-101.

### C. Contributions to Science (continued)

6. Clark SF, Byker CB, Niewolny K, and Helms J. (2013). Framing an Undergraduate Minor through the Civic Agriculture and Food Systems Curriculum, *North American Teachers and Colleges of Agriculture*, 57(2): 56-67.
7. Niewolny K, Grossman JM, Byker CB, Helms JL, Clark SF, Cotton JA, and Jacobsen K. (2012) Sustainable Agriculture Education and Civic Engagement: The Significance of Community-University Partnerships in the New Agricultural Paradigm. *Journal of Agriculture, Food Systems and Community Development*, 2(3): 27-42.
8. Clark SF. Vitamins and Trace Elements. In: The A.S.P.E.N. Nutrition Support Core Curriculum: A Case-Based Approach – The Adult Patient, 3ed 2012:129-162.
9. Galt R, Clark SF and Parr D (2012). Engaging Values in Sustainable Agriculture and Food Systems Education. *Journal of Agriculture, Food Systems and Community Development*, 2(3): 43-54.
10. Schroeder-Moreno MS, Clark SF, Byker CB and Zhao X (2012). Internationalizing Sustainable Agriculture Education. *Journal of Agriculture, Food Systems and Community Development*, 2(3):55-68.
11. Niewolny K, Grossman JM, Byker CB, Helms JL, Clark SF, Cotton JA, and Jacobsen K. (2012) Sustainable Agriculture Education and Civic Engagement: The Significance of Community-University Partnerships in the New Agricultural Paradigm. *Journal of Agriculture, Food Systems and Community Development*, 2(3): 27-42.

### **OTHER REPORTS & MEDIA**

1. Appalachian Foodshed Project Regional Report Community Food Security (2017); [www.appalachianfoodshed.org](http://www.appalachianfoodshed.org).
2. Appalachian Virginia Community Food Security Assessment, Final Report (2016); [www.appalachianfoodshed.org](http://www.appalachianfoodshed.org).
3. Heifer International: Sustainable Community Development and Study Abroad <http://www.heifer.org/blog/2012/05/experiential-learning-for-va-tech-students-in-honduras.html>

### D. Additional Information: Research Support and/or Scholastic Performance

USDA, NIFA-AFRI 2011-68004-30079      Clark (PI)      03/01/11-02/28/17  
Enhancing Food Security By Cultivating Resilient Food Systems & Communities: Place-Based Foodshed Analysis From Research To Community Practice, (Appalachian Foodshed Project).  
Role: PI

USDA, NIFA-AFRI 2009-00879      Clark (PI)      08/01/09 – 07/31/13  
Restoring Community Foodsheds: A Multidisciplinary Curriculum Translating Science into Practical, Innovative and Sustainable Solutions for Economic Viability, Food Security & Health.  
Role: PI

Virginia Cooperative Extension Community Viability Grant (pending)  
Community Innovation and Capacity Building for Regional Food Systems Change: An Appalachian Foodshed Partnership (AFP) Initiative.  
Role: CoPI

Pathways Delivery Grant, Virginia Tech      Clark (PI)      03/15/16 – 02/28/18  
*Civic Agriculture and Food Systems Pathways Minor*.  
Role: PI

Virginia Cooperative Extension Community Viability Grant 09/01/15 – 10/01/16

Creating a Regional Food Systems Roadmap: Building a multi-state network and leveraging area resources.

Role: CoPI

Virginia Cooperative Extension Community Viability Grant Clark (PI) 2012-2013  
Strengthening Rural Communities through the Appalachian Foodshed Project.

Role: PI

College of Agriculture and Life Sciences Competitive Grant, VA Tech 2012-2013  
Developing and Integrating a Service-learning Course with the VCE Master Food Volunteer Program:  
Promoting Safe Preservation, Handling, and Serving of Foods to Virginia Citizens.

Role: CoPI

College Agriculture & Life Sciences Grant, Virginia Tech 2012-2014  
Building Capacity for an Agrarian Living Learning Community.

Role: CoPI

College Agriculture & Life Sciences Grant, Virginia Tech Clark (PI) 2010 –2011  
Transforming Agricultural and Life Science Education: Exploring the Role of Collaborative-based  
Curriculum and Instruction to Enhance Interdisciplinary Teaching and Learning.

Role: PI

Center for Excellence in Undergraduate Teaching Grant, Virginias Tech Clark (PI) 2008-2009  
Faculty and Students Collaborate Using E-Portfolio Design to Enhance the Scholarship of Student  
Learning.

Role: PI

College of Agriculture and Life Sciences Grant, Virginia Tech Clark (PI) 2008- 2009  
Educating Tomorrow's Agents of Change Through an Innovative Curriculum Initiative on Sustainable  
Agriculture and Food Systems

Role: PI

Teaching and Assessment Grant, Virginia Tech Clark (PI) 2007-2008  
Multidisciplinary Student Service Learning; Assessment of Student Outcome Learning (SOLs) Through e-  
Portfolio Technology

Role: PI

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**BIOGRAPHICAL SKETCH**  
**DO NOT EXCEED FIVE PAGES.**

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NAME: Ranganathan, Shyam

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eRA COMMONS USER NAME (credential, e.g., agency login): SHYAMRANGANATHAN

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POSITION TITLE: Assistant Professor of Statistics

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EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.*)

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INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
Indian Institute of Technology-Madras, India	B.Tech.	05/2003	Electrical Engineering
University of Notre Dame, Indiana	M.S.	05/2006	Electrical Engineering
Asian College of Journalism, India	P.G.Dip.	06/2008	Journalism
University of Uppsala, Sweden	Ph.D.	12/2015	Applied Mathematics & Statistics

### **A. Personal Statement**

I have the expertise, leadership, training, and motivation necessary to successfully carry out the proposed research project. I have a broad background in mathematical modeling and statistics with applications to large datasets. My primary research areas are related to time series analysis, network analysis, and statistical modeling applications. I have worked on issues related to sustainable development both as a researcher and as a journalist. Recently, I published a paper that showed that the Sustainable Development Goals, as designed by the United Nations could potentially be contradictory to each other in a business-as-usual scenario. I have experience with clinical datasets as I worked on building an index to gauge limb asymmetry and perform non-parametric tests to identify the difference in limb symmetry between ACL-reconstructed patients and healthy controls. I have also been working on a feature extraction algorithm and an adaptive logistic regression model to help in bio-behavioral monitoring interventions for children with autism. Along with collaborators, I have submitted a proposal to use synthetic populations and multilevel regression models to study the impact of the "total environment" including environment, economic and social stressors etc. on health outcomes. I am also working on network analysis projects involving the coupling of trade and financial networks in countries and the risks and resilience due to the interlinkages between these in times of financial shocks. During my Ph.D., I worked on non-linear dynamic models for child mortality, sustainable development, economic growth and other socio-economic indicator variables. I have a successful track record of interdisciplinary work with mathematicians, economists, political scientists and sociologists on large projects involving more than three different academic departments, and am conversant with the efficient means to handle the issues of communicating and collaborating in teams. I also have a Masters in Electrical Engineering, with specialization in Wireless Communications and in Information Theory.

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### **B. Positions and Honors**

#### **Positions and Employment**

2003-2007 Graduate Research Assistantship + Teaching Assistantship at University of Notre Dame.  
2007-2008 SAF-Madanjeet Singh scholarship to study journalism at Asian College of Journalism.  
2008-2010 Special Correspondent, The Hindu, national newspaper, India.

11/10-04/11 Research Assistant at the Collective Behaviour Laboratory, Uppsala University.  
06/11-12/15 Graduate Research Assistantship from Centre for Interdisciplinary Mathematics and Department of Mathematics, Uppsala University, Sweden.  
2016- Assistant Professor, Department of Statistics, Virginia Tech, VA.

### Other Experience and Professional Memberships

2016- Member, American Statistical Association.  
2014- Invited reviewer for refereed articles in PLOS One, Political Science Research Methods, Chemometrics and Journal of Comparative Psychology.

### Honors

2002-2003 Chess captain for the institute at IIT-Madras.  
2003 Winner of Mathematical modeling competition at IIT-Madras techfest.  
2006 Summer Research Fellowship, Center for Applied Mathematics, University of Notre Dame.  
2008 Best Outgoing Student, Asian College of Journalism.  
2010 Co-ordinator for higher education supplement "Education Plus" for the newspaper  
2012 Sederholm Travel Award (~\$3000) for two month visit to ETH Zurich, Uppsala University.

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### C. Contribution to Science

1. My initial graduate research in Electrical Engineering resulted in the development of a set of new algorithms for new decoder architectures for high-speed wireless communications. The decoding architecture that I worked on as a Masters' student resulted in the publication of multiple research papers.

a. Gopalan, R., Padmanabhan, K., Ranganathan, S., Collins, OM. (2006). Calculating and Achieving Capacity on the Unknown Fading MIMO Channel. *Proc. International Symposium on Information Theory*.

b. Gopalan, R., Ranganathan, S., Padmanabhan, K., Collins, OM. (2006). Rate-Splitting and its Applications for a General Wireless Channel. *Proc. Forty-fourth Annual Allerton Conference on Communication, Control and Computing*, Allerton, Indiana.

2. During my PhD, I developed a novel Bayesian methodology for non-linear dynamic modeling of large datasets. I then applied this methodology, with a team of collaborators including economists, mathematicians, sociologists and political scientists to a number of domain-specific problems. In particular, we studied sustainable development, child mortality and its interactions with fertility rates and economic growth, the evolution of democracy in countries, school segregation etc. Some of these models were built with over 1,400 variables to start with, which were then pruned using variable selection techniques to identify the most relevant dynamic models.

- a. Hall, RP., Ranganathan S., and Raj Kumar GC. (2017). A General Micro-Level Modeling Approach to Analyzing Interconnected SDGs: Achieving SDG 6 and More through Multiple-Use Water Services (MUS). *Sustainability* 9.2: 314.
- b. Spaiser, V., Ranganathan, S., Swain, RB., Sumpter, DJT., (2016). The Sustainable Development Oxymoron: Quantifying and Modeling the Incompatibility of Sustainable Development Goals. *International Journal of Sustainable Development and Ecology*.
- c. Spaiser, V., Hedström, P., Ranganathan, S., Jansson, K., Nordvik, MK., Sumpter, DJT., (2016). Identifying complex dynamics in social systems: The case of school segregation. *Sociological Methods and Research*.
- d. Ranganathan, S., Spaiser, V., Mann, RP., Sumpter, DJT., (2014). Bayesian Dynamical Systems Modeling in the Social Sciences. *PLOS ONE* 9(1).

3. I have also been working on different projects that involve clinical subjects or health-related variables. I am currently writing a paper on developing a new index to measure limb asymmetry and use non-parametric tests on this variable to show the difference in limb symmetry between ACL-reconstructed patients and healthy

controls. I have also been part of a new observational study that aims to identify the association between pre-term births and exposure to particulate matter in areas with active mining operations using hospital records from multiple states over a period of over 20 years. Recently, I was part of an inter-disciplinary team that included psychologists, industrial engineers and computer scientists, that won a seed grant for a project to identify onset of self-injurious behavior in children with autism spectrum disorder using wearable accelerometers and build a predictive model into a device that will remotely trigger warning alerts for caregivers when such behavior is imminent.

4. Recently, I have been working with scholars in engineering education to build a model of the “college experience” and identify the social and learning networks in STEM higher education. Using structural models and network analysis techniques, the data we are collecting from five Universities will help researchers understand means of increasing diversity in STEM fields, and provide data-driven policy interventions to other issues facing students, teachers and administrators in STEM education.

a. Han, J., Simmons, D., Ranganathan, S., (2016). Using social network analysis to examine social engagement in an engineering class. *Journal of Engineering Education*, *in preparation*.

Complete List of Published Work in My Bibliography (9 journal publications, 119 Google Scholar citations):  
[https://www.ncbi.nlm.nih.gov/myncbi/collections/bibliography/52456888/?grant\\_association\\_reload=true&sortby=pac&groupby=citation\\_type&source=pacEdit](https://www.ncbi.nlm.nih.gov/myncbi/collections/bibliography/52456888/?grant_association_reload=true&sortby=pac&groupby=citation_type&source=pacEdit)

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## **D. Research Support**

### **Current Research Support**

Institute for Society, Culture, and Environment seed grant

Ranganathan (PI) Jan-June '17

### **Measuring Academic and Professional Outcomes Gained from the College Experience**

The goal of this study is to use mixed methods research to understand “quality” in higher education from a holistic perspective, including different stakeholders such as the student, faculty, education administrators, employers etc. We perform a systematic review of current literature and attempt to build a statistical model that identifies how different outcomes for different stakeholders are met in the current education system.

Institute for Society, Culture, and Environment seed grant

Ranganathan (co-PI) July '17-June '18

### **Bio-behavioral monitoring of self-injurious behaviors in autism spectrum disorder**

The goal of this project is to use technology monitoring using accelerometers to identify the onset of self-injurious behavior in children with autism, and use feature extraction algorithms to identify the dynamical variables that best predict the onset of such behavior. Using the results from the first stage of the project, we will build an adaptive predictive model that can be built into an app to trigger alerts to caregivers when self-injurious behavior is imminent.

**Stephen H. Schoenholtz**

Director and Professor

Virginia Water Resources Research Center and  
Department of Forest Resources and Environmental Conservation  
Virginia Tech

Phone (540) 231-0711; Fax (540) 231-6673; Email Stephen.Schoenholtz@vt.edu

**A. Professional Preparation**

Pennsylvania State University	Forest Science	B.S. with Distinction, 1979
Pennsylvania State University	Biology	B.S. with Distinction, 1979
Virginia Tech	Forest Biology	M.S. 1983
Virginia Tech	Forest Soils	Ph.D. 1990
Virginia Tech	Restoration Ecology	Postdoc. 1990

**B. Appointments**

**Virginia Tech, Blacksburg, Virginia**

Virginia Water Resources Research Center, *Director*, 2006-Present

Department of Forest Resources and Environmental Conservation, *Professor*, July 2006 to Present

**Oregon State University, Corvallis, Oregon**

Department of Forest Engineering, Resources, and Management, *Associate Professor*,  
*Professor*, 2001-2006, *Courtesy Professor*, 2006-2012

**Mississippi State University, Mississippi State, Mississippi**

Department of Forestry, *Assistant Professor*, *Associate Professor*, *Professor*, 1990-2001,  
*Adjunct Professor*, 2001-Present

Mississippi Water Resources Research Institute, *Director*, 2001

**New Zealand Forest Research Institute, Rotorua, New Zealand**

Soil and Site Productivity Research Group, *Visiting Senior Research Fellow*, January-July  
1998 and January-February 2015

**Virginia Tech, Blacksburg, Virginia**

Department of Crop and Soil Environmental Sciences, *Postdoctoral Research Associate*  
1990

**Texas Forest Service, College Station, Texas**

*Staff Forester II*, 1984-1986

**Columbia University, Palisades, New York**

Lamont-Doherty Earth Observatory, Tree-Ring Laboratory, *Research Assistant*, 1983-1984

**C. Recent Relevant Refereed Journal Publications**

Krenz III, R.J., **S.H. Schoenholtz**, and C.E. Zipper. 2016. Riparian subsidies and hierarchical effects of ecosystem structure on leaf breakdown in Appalachian coalfield constructed streams. *Ecological Engineering* 97:389-399.

Boehme, E.A., C.E. Zipper, **S.H. Schoenholtz**, D.J. Soucek, and A.J. Timpano. 2016. Temporal dynamics of benthic macroinvertebrate communities and their response to elevated specific conductance in Appalachian Coalfield headwater streams. *Ecological Indicators* 64: 171-180.

Christopher, S.F., **S.H. Schoenholtz**, and J.E. Nettles. 2015. Water quantity implications of regional-scale switchgrass production in the southeastern U.S. *Biomass and Bioenergy* 83: 50-59.

- Evans, D.M., C.E. Zipper, E.T. Hester, and **S.H. Schoenholtz**. 2015. Hydrologic effects of surface coal mining in Appalachia (USA). *Journal of American Water Resources Association* 51(5): 1436-1452.
- Slesak, R.A., **S.H. Schoenholtz**, and D.M. Evans. 2015. Hillslope erosion from high-risk sites following wildfire and salvage logging in southern Oregon, USA. *Forest Ecology and Management* 342: 1-7.
- Timpano, A.J., **S.H. Schoenholtz**, D.J. Soucek, and C.E. Zipper. 2015. Salinity as a limiting factor for biological condition in mining-influenced Central Appalachian headwater streams. *Journal of American Water Resources Association* 51(1): 240-250.
- Little, C., J.G. Cuevas, A. Lara, M. Pinto, and **S. Schoenholtz**. 2014. Buffer effects of streamside native forests on water provision in watersheds dominated by exotic forest plantations. *Ecohydrology*. doi: 10.1002/eco.1575
- Evans, D.M., **S.H. Schoenholtz**, P.J. Wigington, Jr., S.M. Griffith, and W.C. Floyd. 2014. Spatial and temporal patterns of dissolved nitrogen and phosphorus in surface waters of a multi-land use basin. *Environmental Monitoring & Assessment* 186(2):873-887.
- Danehy, R.J., R.E. Bilby, R.B. Langshaw, D.M. Evans, T.R. Turner, W.C. Floyd, **S.H. Schoenholtz**, and S.D. Duke. 2012. Biological and water quality responses to hydrologic disturbances in third order forested streams. *Ecohydrology* 5(1):90-98.
- Northington, R.M., E.F. Benfield, **S.H. Schoenholtz**, A.J. Timpano, J.R. Webster, and C.E. Zipper. 2011. An assessment of structural attributes and ecosystem function in restored Virginia coalfield streams. *Hydrobiologia* 671(1):51-63.
- Floyd, W.C., **S.H. Schoenholtz**, S.M. Griffith, J.P. Wigington, Jr., and J.J. Steiner. 2009. Nitrate-N, landuse/landcover, and soil drainage associations at multiple spatial scales. *Journal of Environmental Quality* 38(4): 1473-1482.

#### **D. Grants and Contracts Received**

- Virginia Tech -- \$3,030,000 for my individual research program
  - Administer annual budget for Virginia Water Resources Research Center of \$750,000-\$1,000,000
- Oregon State University -- \$1,164,000 for my individual research program
- Mississippi State University -- \$2,198,000 for my individual research program

#### **E. Graduate Students and Post-docs Supervised**

- Virginia Tech – 8 MS 5 PhD 2 Post-docs
- Oregon State University – 9 MS 3 PhD
- Mississippi State University – 13 MS 2 PhD

#### **F. Synergistic Activities**

- Developed new courses: Properties and Processes of Forested Watersheds, Forest Hydrology, Forest Soils, Advanced Forest Soils, Wetland Ecology and Management at Mississippi State Univ. & Oregon State Univ.
- Coordinated development and now oversee new interdisciplinary B.S. degree program in Water: Resources, Policy, and Management, Virginia Tech.
- *National Institutes for Water Resources*, President-Elect 2015-2016, President 2016-2017
- *Soil Science Society of America*, Former Chair, Forest, Range, and Wildland Soils Division
- *American Water Resources Association*, *Ad Hoc* Science Advisory Council member
- External reviewer for promotion and tenure: Univ. Alberta, Oregon State Univ., Univ. Arizona, Univ. Colorado, Univ. Georgia, SUNY-ESF, Louisiana State Univ., Texas A&M Univ., West Virginia Univ.

- Testified on behalf of the Mississippi State Univ. Forest and Wildlife Research Center before U.S. House of Representatives Subcommittee on Forests and Forest Health
- Organizing Committee, 10<sup>th</sup>, 12<sup>th</sup>, and 13<sup>th</sup> North American Forest Soils Conferences
- Committee Chair, Virginia Department of Environmental Quality Academic Advisory Committee
- International water-resources service activities in Armenia, Chile, Costa Rica, New Zealand, Sweden

**BIOGRAPHICAL SKETCH**

Provide the following information for the Senior/key personnel and other significant contributors.  
Follow this format for each person. DO NOT EXCEED FIVE PAGES.

NAME: Swarup, Samarth

eRA COMMONS USER NAME (credential, e.g., agency login): swarup

POSITION TITLE: Research Assistant Professor

EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.*)

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
University of Bombay, Mumbai, India	B. Eng.	07/1998	Computer Engineering
University of Illinois at Urbana-Champaign, Champaign, IL	Ph.D.	10/2007	Computer Science
University of Illinois at Urbana-Champaign, Champaign, IL	Postdoctoral	08/2008	Language Evolution
Virginia Polytechnic Institute and State University, Blacksburg, VA	Postdoctoral	08/2011	Simulation Science

**A. Personal Statement**

I have a broad background in systems science approaches to public health problems, having developed agent-based and ODE-based models in multiple domains, including the spread of smoking in adolescent networks, infectious disease epidemiology, language evolution and diffusion, incarceration, and disaster recovery. As a researcher at Virginia Tech, I have been working on large-scale simulations of data-driven, realistic, synthetic populations that have been developed here over many years, and have been developing simulations that take into account individual behavior as well as environmental and infrastructural factors. In particular, I have developed a detailed microsimulation model of population heat exposure in Alabama. I have also worked on modeling detailed activity patterns in the context of the spread of influenza. This project will benefit from my expertise in data science, simulation science, network science, and machine learning.

**B. Positions and Honors****Positions and Employment**

2007-2008 Postdoctoral Research Associate, Graduate School of Library and Information Science, University of Illinois at Urbana-Champaign, Champaign, IL

2008-2011 Postdoctoral Research Associate, Network Dynamics and Simulation Science Lab, Virginia Bioinformatics Institute, Virginia Polytechnic Institute and State University, Blacksburg, VA

2012- 2015 Applied Computer Scientist, Network Dynamics and Simulation Science Lab, Virginia Bioinformatics Institute, Virginia Polytechnic Institute and State University, Blacksburg, VA

2015- Research Assistant Professor, Network Dynamics and Simulation Science Lab, Virginia Bioinformatics Institute, Virginia Polytechnic Institute and State University, Blacksburg, VA

## **Other Experience and Professional Memberships**

2012-2013	Chair, AAI Fall Symposium on Social Networks and Social Contagion
2013	Chair, Workshop on Multiagent Interaction Networks at AAMAS 2013
2014	Co-organizer, AAI Spring Symposium 2014 on Applied Computational Game Theory
2016	Co-organizer, Workshop on Computational Modeling of Attitudes at IJCAI 2016
2016	Co-organizer, Tutorial on Generating Synthetic Populations for Social Modeling, at AAMAS 2016 and IJCAI 2016.

## **Honors**

2009	Poster winner: at the NICO Complexity Conference, 2009.
2012	Best student paper award: To my student, Gaurav Tuli, for a jointly authored paper at The International Conference on Social Computing, Behavioral-Cultural Modeling, and Prediction (SBP).
2014	Best student paper award: To my student, Nidhi Parikh, for a jointly authored paper at The International Conference on Social Computing, Behavioral-Cultural Modeling, and Prediction (SBP).
2014	Blue Sky Ideas best paper award: At the Autonomous Agents and Multiagent Systems (AAMAS) Conference.
2016	First prize, NIEHS Climate Change and Environmental Exposures Challenge for PIE Viz, Populations, Infrastructures, and Exposures Visualization Tool with Julia Gohlke and Dawen Xie.

## **C. Contribution to Science**

1. I have developed and implemented a computational model of human behavior in the aftermath of a major disaster. The scenario is the detonation of an improvised nuclear device at ground level in the middle of Washington DC. The model is based on surveys of behavior in disasters as well an extensive literature review. This model instantiates six behaviors: household reconstitution, shelter-seeking, healthcare-seeking, information-seeking, evacuation, and aiding & assisting others. This work has shown the importance of detailed behavior modeling in simulations of disaster scenarios. Earlier efforts in the literature, which have either ignored human behavior or have built simplified models of just one or two behaviors, come up with overly optimistic estimates of outcomes such as casualty rates. Note that some of the papers listed below are aimed at computer science audiences and thus have appeared as rigorously reviewed conference papers.

- a) Bryan Lewis, **Samarth Swarup**, Keith Bisset, Stephen Eubank, Madhav Marathe, and Chris Barrett (2013). A Simulation Environment for the Dynamic Evaluation of Disaster Preparedness Policies and Interventions. *The Journal of Public Health Management and Practice* 19, S42-S48. PMID: 23903394 PMID: PMC3962069.
- b) Nidhi Parikh, **Samarth Swarup**, Paula Stretz, Caitlin Rivers, Bryan Lewis, Madhav Marathe, Stephen Eubank, Christopher Barrett, Kristian Lum, and Youngyun Chungbaek (2013). Modeling Human Behavior in the Aftermath of a Hypothetical Improvised Nuclear Detonation. In Proceedings of the Twelfth International Conference on Autonomous Agents and Multiagent Systems (AAMAS), Saint Paul, MN, USA.
- c) Shridhar Chandan, Sudip Saha, Christopher Barrett, Stephen Eubank, Achla Marathe, Madhav Marathe, **Samarth Swarup**, and Anil Kumar Vullikanti (2013). Modeling the Interactions between Emergency Communications and Behavior in the Aftermath of a Disaster. In Proceedings of the International Conference on Social Computing, Behavioral-Cultural Modeling, and Prediction (SBP), Washington DC, USA.
- d) Abhijin Adiga, Madhav V. Marathe, Henning S. Mortveit, Sichao Wu, **Samarth Swarup** (2013). Modeling Urban Transportation in the Aftermath of a Nuclear Disaster: The Role of Human Behavioral Responses. In Proceedings of the Conference on Agent-Based Modeling in Transportation Planning and Operations, Blacksburg, VA, USA.

2. My work on modeling the effects of transient populations on influenza epidemics has shown that, in large cities like Washington DC where there are significant numbers of tourists and business travelers every day, these populations can have a significant impact on epidemics (making them worse) because the rapid turnover



Role: Key Personnel

DTRA, HDTRA1-11-D-0016

Madhav Marathe

10/01/13-09/30/15

Novel Methods and Software Systems for Inference and Modeling of Behavior for Epidemic Surveillance, Planning and Response (CNIMS Task 4)

The objectives of this proposal are to develop novel methods that leverage recent advances in social media, online-labor markets and pervasive computing to infer individual and collective behaviors and study their impact on epidemic planning and response.

Role: Key Personnel

DTRA , HDTRA1-11-D-0016/0001

Christopher Barrett

10/01/11-09/28/17

Comprehensive National Incident Management System (CNIMS) - Task 1

The goal of this proposal is to research and develop computational decision support platforms for complex socio-technical systems.

Role: Key Personnel

**BIOGRAPHICAL SKETCH**

Provide the following information for the Senior/key personnel and other significant contributors.  
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Christopher Kirk Thompson

eRA COMMONS USER NAME (credential, e.g., agency login): CKTHOMP

POSITION TITLE: Assistant Professor

EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.*)

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
University of Illinois -- Champaign-Urbana, IL	BS	06/2000	Ecology, Ethology, & Evolutionary Biology
University of Illinois -- Champaign-Urbana, IL	Minor	06/2000	Chemistry
University of Washington – Seattle, WA	PhD	06/2008	Neurobiology & Behavior
Freie Universität – Berlin, Germany (postdoc)	n/a	n/a	Molecular Neuroscience
The Scripps Research Institute – La Jolla, CA (postdoc)	n/a	n/a	Developmental Neurobiology

**NOTE: The Biographical Sketch may not exceed five pages. Follow instructions below.**

**A. Personal Statement**

My long term research focuses on how hormones and exogenous hormone-disrupting compounds affect the development and stability of brain circuits. I have been trained in the fields of behavioral neuroscience, neuroendocrinology, neuroplasticity, and neurotoxicology. My research career began as a Howard Hughes Medical Institute undergraduate research fellow under the supervision of Prof Gene Robinson at the University of Illinois-CU, where I examined the effects of the insecticide metrifonate on olfactory conditioning in honey bees, resulting in two publications. As a graduate student in the lab of Prof Eliot Brenowitz, my research focused on hormonal control of apoptotic mechanisms in the brain circuit that controls singing behavior in songbirds. This research led to many important findings, nine publications, and was featured in several press articles. I continued working with songbirds under Prof Constance Scharff, having received a fellowship from the prestigious Alexander von Humboldt Foundation. My main research project there focused on hormonal regulation of FoxP2 expression, a gene critical for vocal learning in humans and songbirds. I have published four articles from my postdoctoral time in Berlin. Once my fellowship ended, I joined Prof Hollis Cline's lab at The Scripps Research Institute to study the effects of thyroid hormone-disrupting compounds on retino-tectal brain circuitry in *Xenopus laevis* tadpoles. I received mentorship in her laboratory that was the basis of the K99 portion of my current funding, where I focused on mechanisms regulating retinotectal map formation, retinal axon and tectal cell dendritic arbor dynamics and neuronal connectivity. While in Prof Cline's lab I was trained in *Xenopus* husbandry, whole-mount histology, *in vivo* time-lapse imaging, targeted gene expression manipulation via electroporation, and quantitative PCR. I am uniquely suited to address the questions in this proposal because I am an expert in careful quantification of how factors that act via hormonal mechanisms shape and alter brain morphology, as well as the molecular and cellular mechanisms that underlie neural circuit development.

## B. Positions and Honors

### Employment

ACTIVITY/OCCUPATION	BEGINNING DATE (mm/yy)	ENDING DATE (mm/yy)	FIELD	INSTITUTION/COMPANY	SUPERVISOR/EMPLOYER
Postdoc	09/08	08/11	Neurobiology	Freie Universität	Prof. Constance Schaff
Postdoc	09/11	06/16	Neurobiology	The Scripps Research Institute	Prof. Hollis Cline
Asst Professor	07/16	present	Neurobiology	Virginia Tech	School of Neuroscience

### Honors

- Society for Behavioral Neuroendocrinology Young Investigator Award: Jun 2013
- California Institute of Regenerative Medicine Stem Cell Training Program: Oct 2011-Oct 2013
- University of Antwerp International Scientific Cooperation Special Research Fund: Oct 2011-Sept 2012 (not accepted)
- Alexander von Humboldt Stipendium, post-doctoral fellow: July 2008-Oct 2010
- University of Washington Neuroscience Training Program, Trainee: Sept 2005-June 2008
- Auditory Neuroscience Training Program, Trainee: Sept 2002-Aug 2005
- Outstanding Student Award in Ecology, Ethology and Evolution; May 2000
- Graduated with distinction in Ecology, Ethology, and Evolution; May 2000
- Awarded "Outstanding teaching assistant" for Chem 105, Fall 1999 and Chem 106E, Spring 2000.
- University of Illinois Dean's List: Spring 1997, Spring 1998, Fall 1998, Spring 1999, Fall 1999, Spring 2000.
- US Air Force Excellence in Math and Science Award: June 1996

## C. Contribution to Science

Thyroid hormone regulates early brain development in tadpoles: It has long been known that thyroid hormone is a critical regulator of perinatal brain development in vertebrates. The contribution of thyroid hormone to the early stages of brain development is less well understood. While a postdoc in Holly Cline's lab at The Scripps Research Institute, I determined that a local increase in endogenous thyroid hormone signaling increases neuronal proliferation in the optic tectum, and that blockade of endogenous thyroid hormone production reduces proliferation in the tectum. I also showed using *in vivo* imaging techniques that thyroid hormone increases the rate of neuronal differentiation and dendritic arborization. Thyroid hormone induces major changes in brain morphology, including an increase in optic tectum volume; this is accompanied by an increase in tectal cell death (I developed a novel cell death protocol that became a part of a collaborative project with other Cline lab members). Thyroid hormone also induces rapid and robust changes in expression of genes that regulate cellular functions important for brain development. These results establish thyroid hormone-sensitive endpoints in the developing tadpole visual system that will serve as a springboard for experiments on thyroid hormone disrupting compounds.

### Research articles and related research products:

**Thompson CK**, Cline HT. 2016. Thyroid hormone acts directly on tectal neurons to induce major changes in neurogenesis, differentiation, and neuron morphology in *Xenopus laevis* tadpoles. *J Neurosci.* 2016 Oct 5;36(40):10356-10375.

McKeown CR\*, **Thompson CK\***, Cline HT. 2017. Reversible Developmental Stasis in Response to Nutrient Availability in the *Xenopus laevis* CNS. *J Exp Biol.* 2017 Feb 1;220(Pt 3):358-368.

Faulkner RL, Wishard TJ, **Thompson CK**, Liu HH, Cline HT. 2016. FMRP regulates neurogenesis *in vivo* in *Xenopus laevis* tadpoles. *eNeuro.* 2(1):e0055. PMID: PMC4384423

**Thompson CK**, Medgyesy KD, Turken M, Cline HT. 2015. The tadpole visual system as a model for assessing the effects of thyroid hormone disruption on brain development. Poster; Society for Neuroscience Annual Meeting. Chicago, IL

**Thompson CK**. 2016. The Canary in the Coal Mine: *Xenopus* Tadpole Optic Tectum Development as a Biosensor for Disruption of Thyroid Hormone Signaling. Invited Symposium Presentation: Reciprocal Synergism: New Insights into Thyroid Hormone Action in Brain Development and Neurodevelopmental Toxicity. Society of Toxicology Annual Meeting. New Orleans, LA

Mechanisms that regulate song control system development in zebra finches: The production, memorization, and perception of song in songbirds is regulated by a series of discrete, interconnected brain areas known as the song control system. How this system develops has been a major research focus for many years, but there are still open questions about what mechanisms regulate the development of this system. As a postdoc in Constance Scharff's laboratory in Berlin, Germany, I worked on three projects that addressed this issue in zebra finches, the commonly used model for these kinds of experiments. First, I spearheaded a project to ascertain developmental changes in expression of FoxP2, a transcription factor important for vocal learning in birds and humans, within the song control system. I found that expression can be broken into two cell types, intensely-stained and weakly-stained. Juvenile birds have 10X more intensely-stained cells than adults, and that intensely-stained cells are most likely to be new cells. The number of intensely-stained cells was directly proportional to variability of song. Second, I launched a project to examine the precise anatomical connectivity of muscles in the syrinx, the songbird vocal organ. We used  $\mu$ CT scanning to create a 3D model of the syrinx and found that muscle anatomy was much more complex than previously recognized. This research received the BMC annual Animal Science, Veterinary Research and Zoology Research Award in 2013. Third, I co-lead a project (along with fellow postdoc Mariam Honarmand) to investigate the effects of nutritional stress on neurogenesis in the developing song control system. We found the nutritional stress lowered the rate of neurogenesis, which ultimately compromises singing behavior in adulthood.

#### Research articles and related research products:

**Thompson CK**, Schwabe F, Schoof A, Mendoza E, Gampe J, Rochefort C, Scharff C. 2013. Young and intense: FoxP2 immunoreactivity in Area X varies with age, song stereotypy, and singing in male zebra finches. *Front Neural Circuits*. 2013 Feb 28;7:24 PMID: PMC3584353

Düring D, **Thompson CK**, Ziegler A, Faber C, Müller J, Ziegler A, Scharff C, Elemans C. 2013. The songbird syrinx morphome: a three-dimensional, high-resolution, interactive morphological map of the zebra finch vocal organ. *BMC Biol*. 11(1):1. PMID: PMC3539882

Honarmand M\*, **Thompson CK**\*, Schatton A, Kipper S, Scharff C. 2016. Early developmental stress negatively affects neuronal recruitment to avian song system nucleus HVC. *Dev Neurobiol*. 76(1):107-18. PMID: 25980802

Scharff C and **Thompson CK**. 2013. A birds-eye view of FoxP2. Contribution to "Birdsong, Speech and Language: Converging mechanisms" MIT Press.

Mechanisms that regulate seasonal regression of the song control system: Seasonally breeding songbirds have elevated levels of circulating testosterone in the spring breeding season, when they sing at very high rates and have stable song production. The onset of spring induces testosterone production, which induces an increase in size, neuron number, and density in several areas in the song control system. Once breeding is over, testosterone levels decrease and the song control system regresses. My dissertation in Eliot Brenowitz's lab at the University of Washington investigated the mechanisms that regulate seasonal regression of the song control system. I found that an acute withdrawal of testosterone via castration induced a rapid decrease in song control system morphology, with effects observed within 12 hours of withdrawal. I found aspects of song control system regression are mediated by caspase-dependent programmed cell death. I further investigated if testosterone acts directly to prevent regression of song control system brain areas by infusing testosterone directly into the brain via an osmotic pump and cannula system. Last, I lead a microarray project on seasonal changes in gene expression of two brain areas in the song control system. These studies filled in important

gaps in our understanding of song control system seasonal plasticity and demonstrated that testosterone can act directly on brain areas to prevent regression of sex-steroid sensitive brain areas.

Research articles and related research products:

**Thompson CK**, Meitzen J, Replogle K, Drnevich J, Lent KL, Wissman AM, Farin F, Bammler TK, Beyer RP, Clayton DF, Perkel DJ, Brenowitz EA. 2012. Seasonal changes in patterns of gene expression in avian song control brain regions. PLoS One 7(4):e35119. PMID: PMC3329558

**Thompson CK**, Brenowitz EA. 2010. Neuroprotective effects of testosterone in a naturally-occurring model of neurodegeneration in the adult avian song control system. J Comp Neurol. 2010 Dec 1;518(23):4760-70. PMID: PMC2963470

**Thompson CK**, Brenowitz EA. 2008. Caspase inhibitor infusion protects an avian song control circuit from seasonal-like neurodegeneration. J Neurosci 28:7130-6. PMID: PMC2600584

**Thompson CK**, Bentley G, Brenowitz EA. 2007. Rapid seasonal-like regression of the adult avian song control system. Proc Natl Acad Sci U S A 104:15520-5. PMID: PMC2000488

Mechanisms that regulate olfactory-based memory in honey bees: Honey bees, like all eusocial hymenopterans, split colony tasks into castes. Honey bees exhibit age polyethism, i.e. the task they perform changes as they age. Bees that perform in-hive tasks, called nurses, are young bees. As they age, they cease in-hive tasks and leave the hive to collect nectar and pollen; these older bees are called foragers. Foraging honey bees depend upon olfactory cues to guide nectar collection because the flower species generating nectar vary over the summer months. Nurses, however, don't forage at all. As an undergraduate, I worked with PhD candidate Yehuda Ben-Shahar in Gene Robinson's laboratory at UIUC to study how caste designation affects olfactory memory consolidation and recall. The Robinson lab had previously shown that the areas of the honey bee brain that regulate olfaction change substantially as they transition from nursing to foraging. We tested if caste had an impact on olfactory memory using an olfaction-based conditioning paradigm in laboratory condition. We found that foragers learn to associate an odor with a reward (sugar solution) faster than nurses, but that nurses extinguish that association more quickly once the reward is switched to a punishment (salt solution). I followed this study using the insecticide metrifonate, which acts by inhibiting acetylcholinesterase, which is highly expressed in the olfactory areas of the honey bee brain. I found that metrifonate compromised consolidation of olfactory memories in both nurses and foragers. These studies revealed that age-related changes in brain areas that mediate olfactory memory consolidation correlate with substantial shifts in memorization performance and that compounds that acetylcholine signaling impact these behaviors.

Research articles and related research products:

Shapira M, **Thompson CK**, Soreq H, Robinson G. 2001. Changes in neuronal acetylcholinesterase gene expression and division of labor in honey bee colonies. J Mol Neurosci 17:1-12. PMID:11665858

Ben-Shahar Y, **Thompson CK**, Hartz SM, Smith BH, Robinson GE. 2000. Differences in performance on a reversal learning test and division of labor in honey bee colonies. Animal Cognition 3:119–125.

Candidates for Research Supplements to Promote Diversity in Health-Related Research who are high school students, undergraduates, and postbaccalaureates are not required to complete this section.

Briefly describe up to five of your most significant contributions to science. While all applicants may describe up to five contributions, graduate students and postdoctorates are encouraged to consider highlighting two or three they consider most significant. Descriptions may include a mention of research products under development, such as manuscripts that have not yet been accepted for publication.

Each contribution should be no longer than one half page, including citations. These contributions do not have to be related to this project. For each contribution:

- Indicate the historical background that frames the scientific problem; the central finding(s); the influence of the finding(s) on the progress of science or the application of those finding(s) to health or technology; and your specific role in the described work.
- You may cite up to four papers accepted for publication or research products that are relevant to the contribution.
  - Research products can include audio or video products; conference proceedings such as meeting abstracts, posters or other presentations; patents; data and research materials; databases; educational aids or curricula; instruments or equipment; models; protocols; and software or netware.
  - These citations do not have to be authored by you.

You may provide a URL to a full list of your published work. This URL must be to a Federal Government website (a .gov suffix). NIH recommends using [My Bibliography](#). Providing a URL to a list of published work is not required, and reviewers are not required to look at the list.

#### D. Research Support

Career Transition Award - R00ES022992 (Thompson, CK) 10/16-09/19  
National Institute of Environmental Health Science

This project examines the effects of thyroid hormone disrupting compounds on the development of the tadpole retino-tecal system.

Career Transition Award - 1K99ES022992 (Thompson, CK) 08/13-07/15  
National Institute of Environmental Health Science

This project establishes the development of the tadpole retino-tecal system as a model to study the effects of thyroid hormone disrupting compounds on brain development.

Postdoctoral Fellowship (Thompson, CK) 10/11-10/13  
California Institute for Regenerative Medicine Interdisciplinary Stem Cell Training Program

This project focuses on the impact of changes in neuronal proliferation on the retino-tecal circuit in tadpoles.

Postdoctoral Fellowship (Thompson, CK) 9/08-12/10  
Alexander von Humboldt Stipendium

This project focused on the influence of sex steroid hormones on FoxP2 expression in the song control system.

**Appendix II: Funding Opportunities and Relevant Funding of Steering Committee Members**

**Table 1. Relevant funding opportunities, recent and current**

<b>Title</b>	<b>Sponsor</b>	<b>Amount</b>
Environmental Health Sciences Core Centers	NIH	\$10M
Centers of Excellence on Environmental Health Disparities Research	NIH/EPA	\$5M
Agricultural Health and Safety Research Center	CDC/NIOSH	\$5M
Grand Challenges Explorations	Gates Foundation	up to \$5M
Predictive Multiscale Models for Biomedical, Biological, Behavioral, Environmental and Clinical Research (U01)	NIH, ARO, DOE, FDA, NASA, NSF, ONR	\$4M
Environmental Influences on Placental Origins of Development	NIH	\$3.2M
Powering Research through Innovative Methods for Mixtures in Epidemiology (PRIME)	NIH	\$2.7M
The Preconception Exposure Window and Health of the Offspring	NIH	\$2.4M
Research to Action: Assessing and Addressing Community Exposures to Environmental Contaminants	NIH	\$2M
Early-life Factors and Cancer Development Later in Life	NIH	\$2M
Environmental Exposures and Health: Exploration of Non-traditional Settings	NIH	\$2M
Dynamics of Coupled Natural and Human Systems (CNH) Program	NSF	up to \$1.8M
Cooperative Training Partnership in Aquatic Toxicology and Ecosystem Research	EPA	\$1.2M
Using a Total Environment Framework (Built, Natural, Social Environments) to Assess Life-long Health Effects of Chemical Exposures	EPA	\$800,000
Evidence for Action: Investigator-Initiated Research to Build a Culture of Health	Robert Wood Johnson Foundation	up to \$750,000
Integrating Human Health and Well-being with Ecosystem Services	EPA	\$600,000
Rural Health and Safety Education Competitive Grants Program (RHSE)	USDA	up to \$350,000

**Table 2. Relevant previous and current funding of steering committee members**

<b>Title</b>	<b>Sponsor</b>	<b>Amount</b>
Environmental Exposures Across Urban and Rural Communities in the Deep South	NIH	\$2M
Extreme Heat Events: Evolving Risk Patterns in Urban and Rural Communities	NIH	\$480,000
Rapid Methods to Estimate Exposure to SVOCs in Indoor Environments	EPA	\$900,000
Effects of Dietary Nitrogen Manipulation on Ammonia Emissions from Housing and Manure Storage Facilities	USDA-NIFA	\$499,531

What's in Your Water? Linking Rural Health and Household Drinking Water Safety	USDA-NIFA	\$195,193
New Methods for the Direct Quantification of Air Pollutant Emissions and Education of the Next Generation of Engineers	NSF	\$406,990
Characterization of Sources and Processes of Primary and Secondary Particulate Matter (PM) and Precursor Gases in the California-Mexico Border Region	NSF	\$178,310
SHENAIR: Modeling Air Quality in the Shenandoah Valley	NOAA	\$145,998
Assessment of Natural Resources and Watershed Conditions for Four NPS Units in the Southeastern Coastal Network of Parks	National Park Service	\$126,495
How does current management of water quality align with ecological health and human well-being?: A preliminary study of Virginia	GCC/ISCE Seed Grant	\$23,750
How Does Environmental Landscape Change Shape Community and Ecological Health in the Central Appalachian Coalfields? A Pilot Study in Tazewell County, Virginia	GCC/ISCE Seed Grant	\$20,000
Parental Emotion Socialization in Appalachia, Tazewell County, Virginia	ISCE Summer Scholars Grant	\$20,000
Tazewell County Cancer Project	Tazewell Cty Board of Supervisors	\$15,000
Home Radon Testing in Tazewell County, VA	Virginia Department of Health/EPA	\$11,000
Radon Education, Testing, and Mitigation in Rural Communities	ICTAS Seed Grant	\$10,000
Assessment of Biological Water Quality Impairments in Central Appalachian Mining Communities	Appalachian Research Initiative for Environmental Science	\$440,000
Environmental Health Concerns and Disparities in the Central Appalachian Region of the United States	ISCE	\$5,000
Talking About Work Oral History Digitization Project, Montgomery County, Virginia	VT South Atlantic Ctr & Niles Research Grant	\$4,000

## **Appendix III: Provisional Job Advertisement**

## **Faculty Cluster Hire in Ecological and Human Health in Rural Communities**

Virginia Tech invites applications for new faculty positions that are part of a cluster hire to build upon university-wide strengths in ecological and human health in rural communities. These new positions are part of a major university investment to significantly enhance cutting-edge scholarship and learning in Global Systems Science. The Global Systems Science Destination Area (GSS DA) is envisioned to be a transformative approach to problem solving that harnesses the unique strengths of Virginia Tech together with its institutional culture and mandate for service. The GSS DA is focused on critical problems that cross the nexus of natural and human systems: <http://provost.vt.edu/destination-areas/da-global-systems.html>

The successful candidates will join interdisciplinary research and teaching teams engaged in the Healthy Rural Communities theme within the GSS DA. The Healthy Rural Communities theme is a highly collaborative interdisciplinary community of scholars taking a holistic approach to understanding the connections between human and ecological health in rural landscapes. Candidates who have experience leading or participating in collaborative teams and performing interdisciplinary research that considers interactions between the biogeophysical sciences and the sociocultural realm, using novel technologies, tools, and methodologies, are strongly encouraged to apply.

Successful candidates will collaborate with outstanding Virginia Tech investigators working in rural communities and specializing in geography, natural resources and ecology, public health, Appalachian studies, and environmental engineering. They will help build cohesion and capability (such as graduate training and joint courses) among the large and diverse group of faculty interested in human and ecological systems. A successful candidate will be expected to (1) develop a widely recognized research program that attracts external funding, (2) mentor and supervise doctoral and master's students, (3) support the teaching mission at both graduate and undergraduate levels, and (4) interact effectively with other members of the cluster.

With strategic investments through this cluster, Virginia Tech will be uniquely positioned to respond to the need for evidence-based solutions to environmental change and health disparities currently present in Appalachia, and for a more comprehensive understanding of the role of rural communities and landscapes as part of the global system.

Environmental Epidemiologist: Focus areas of interest include use of remotely sensed datasets, spatial analytical approaches, community-engaged approaches, and personal exposure assessment.

Aquatic Toxicologist: Focus areas of interest include chronic/multigenerational endpoints and evaluation of mixtures/multi stressor human exposures relevant to large-scale landscape changes associated with resource extraction and/or agriculture.

Demographer: Focus areas of interest include combined examination of human and wildlife populations, in-flow and out-flow migration patterns associated with large-scale landscape change in rural communities.

Human/Ecological Risk Assessor: Focus areas of interest include use of *in vitro* and alternative animal model data in risk assessment of combined or multi stressor exposures, harmonization of human and ecological risk analysis.

Oral Historian: A publicly engaged scholar whose focus areas of interest include digital humanities, public history, and local/regional history.

***Additional positions opening at a later date:***

Environmental Psychologist: Focus areas of interest include quality and type of natural setting exposure, impacts on chronic disease management.

Soil Toxicologist: Focus areas of interest include chronic/multigenerational endpoints and evaluation of mixtures/multi stressor human exposures relevant to large-scale landscape changes associated with resource extraction and/or agriculture.

Rural Policy Specialist: Focus areas of interest include rural health public policy, rural environmental policy, environmental planning and policy, social-ecological resilience.

Sustainable Food Systems Expert: Focus areas of interest include the environment and human health and equity, including economic, racial and ethnic, and rural disparities in food distribution, relationships between food systems and environmental health, or implications for under- or over-nutrition and related health outcomes; ecological or evolutionary aspects of the food system, from domestication to production to consumption.

Ecosystem and Human System Modeler: Coupled human - ecological networks in agroecosystems; space-time analysis of human and ecological health indicators.

Environmental Economist: Coevolution of human economies and natural ecosystems; supply, demand, and allocation of natural resources particularly as it relates to rural economies.

Health educator: Medical and public health training in environmental determinants of health with specific knowledge of rural health care workforce.