DEPARTMENT OF
ENVIRONMENTAL
SCIENCE & TECHNOLOGY

Undergraduate Program	Graduate Program
Ecological Technology Design	Soil and Watershed Sciences
Ecosystem Health	Ecological Technology Design
Soil and Watershed Science	Wetland Science
Natural Resources Management	Ecosystem Health & Natural Resource Management

Coupled Human-Natural Systems: Linking Ecosystem and Human Health

Professor Paul Leisnham combines social, ecological, and engineering expertise to explore the two-way links within human and natural systems. His scholarship centers on two critical environmental challenges facing Maryland, the US, and communities worldwide: 1. Invasion and control of medically important mosquitoes; and 2. Watershed health and sustainability.

Medically Important Mosquitoes

Infectious diseases that are transmitted by mosquitoes have killed more people than all the wars combined. They can spread rapidly and have complex epidemiologies that are susceptible to changing social and ecological conditions. Outbreaks of emerging mosquito-borne diseases, such as Zika, Chikungunya, and Rift Valley fever viruses have revealed new vulnerabilities to the US and around the world, especially along social and ecological boundaries. Dr. Leisnham's recent research has identified ecological conditions facilitating greater mosquito infestation and human exposure along social and economic gradients – including inequitable investments in community amenities, resident perceptions of the environment, and resident outdoor behaviors. To combat such risks his program is testing the efficacy of a range of education models for helping communities, including those that have been historically underserved, manage urban vector populations.

Watershed Health and Sustainability

Dr. Leisnham also applies coupled human-natural systems theory to help solve stormwater runoff, which is a significant threat to the health and sustainability of watersheds in the Chesapeake Bay basin and worldwide. He has led interdisciplinary teams of researchers and community partners to yield ground-breaking insights in both urban and agricultural settings, including identifying pollution hotspots and prescribing targeted Best Management Practices using hydrological models and innovative decision support tools, and revealing complex relationships among social factors – including resident demographics, knowledge, attitudes, and practices to identify socioeconomic barriers to effective stormwater management and inform targeted education outreach.

Linking Greenspace, Stormwater, Trash, and Mosquitoes in Urban Areas

Dr. Leisnham is currently leading a multi-institutional, interdisciplinary NSF project to better understand how urban watersheds can be improved through better stormwater management. The work is focused on two watersheds in Washington, District of Columbia and Baltimore, Maryland that are plagued by varying ecological (e.g., vacant lots, broken sewers, trash, mosquitoes) and social (e.g., gentrification, environmental misunderstanding, negative attitudes to green space) symptoms of urban decay, and with different levels of urban revitalization (e.g., occupied lots, greening, developed education programs). To do this, Dr. Leisnham and colleagues will quantify the strength of important healthy and unhealthy cycles and their critical feedback and intervention pathways within and between stormwater and human systems. It will test whether unhealthy couplings are expressed preferentially in the neighborhoods with higher decay and less revitalization and will compare the effectiveness of stormwater and human (at community and household levels) interventions at displacing unhealthy couplings.

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