INTEGRATING ENVIRONMENTAL DATA ACROSS SPATIAL SCALES

ASSOCIATION OF ECOSYSTEM RESEARCH CENTERS

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Dr. Mark Elliott is Associate Professor in Environmental Engineering at the University of Alabama. His doctoral and post-doctoral research at UNC Chapel Hill addressed issues primarily in developing countries and his recent work focuses largely on wastewater management in the rural southeastern US.

Wastewater Management Challenges in the Rural Alabama Black Belt: Conditions and a Path Forward

Abstract. Roughly 75% of the U.S. population disposes of household wastewater through connection to a public sewer; the remaining ~80 million people are required by law to provide their own wastewater management, typically using a conventional septic system. Septic systems rely on a septic tank to settle and digest solids with liquids infiltrated into the ground. However, septic systems cannot function in all soil and geological conditions and the alternative advanced onsite wastewater treatment systems (OWTS) are prohibitively expensive for low-income households. In communities with unsuitable soil/geological conditions, no sewer access, and high levels of poverty, proper wastewater management can be challenging or impossible. Recent evidence reveals that discharge of raw sewage from homes directly to the surface (“straight piping”) is relatively common in underserved rural communities of the US (Maxcy-Brown et al., 2021). The Black Belt region of central Alabama is characterized by rural poverty, shrink-swell clay that causes conventional septic systems to fail, and low population density that makes centralized sewer infeasible for most communities. In some Black Belt counties, up to half the population uses a straight pipe to discharge wastewater to the surface. This presentation will summarize our efforts to characterize the nature, scope and effects of household-level wastewater failures in the Black Belt before addressing our progress identifying technical, financial, management, and regulatory barriers and implementing

sustainable solutions. The wastewater system typologies considered include: (1) expansion of conventional sewer, (2) installation or repair of conventional septic systems and OWTS, and (3) decentralized clustered wastewater systems. While sewer expansion and subsidized OWTS may be appropriate in some areas, costs are high and increasing. Decentralized clustered systems may provide a cost-effective option with declining component costs (e.g., treatment membranes, sensors, data transfer) and substantial economies of scale for operations and management (O&M) as more systems are installed. However, management, workforce, and regulatory considerations varying locally and are critical for sustainable finance and operation of decentralized clustered. Given anticipated increases in Federal funding for rural wastewater infrastructure, it is essential that stakeholders understand the breadth of wastewater management solutions available for rural communities in the U.S.

Reference:
Maxcy-Brown, J., M.A. Elliott, L.A. Krometis, J. Brown, K.D. White and U. Lall (2021) Making Waves: Right in Our Backyard - Surface Discharge of Untreated Wastewater from Homes in the United States. Water Research. 190: 116647. https://doi.org/10.1016/j.watres.2020.116647

Dr. Paula Mabee

Chief Scientist and Observatory Director, National Ecological Observatory Network (NEON), Battelle

Dr. Paula Mabee became the Chief Scientist and Observatory Director for the National Ecological Observatory Network (NEON) in early 2020. Previous to this she was a Nolop Distinguished Professor in the Department of Biology at the University of South Dakota, serving in that capacity since 1997. From 2015-2017 she served as Division Director for the Division of Environmental Biology in the Directorate of Biological Sciences at the National Science Foundation (NSF). Prior to 1997, she held assistant and associate professorships at San Diego State University.

Dr. Mabee holds B.A.s in Biology and Religion from St. Olaf College in Minnesota, and a Ph.D. in Zoology from Duke University. She was a postdoctoral fellow at the Smithsonian Institution in the Division of Fishes, followed by a NSF postdoc at Dalhousie University in Nova Scotia. During her career, Mabee has authored more than 60 research publications, received many NSF awards and one NIH research grant, and held numerous editorial, advisory board, and society positions including president of the Society of Systematic Biologists. She was named an AAAS Fellow in 2004 for her fundamental studies in evolutionary and developmental biology and in 2020 awarded the Joseph S. Nelson Lifetime Achievement Award in Ichthyology from the American Society of Ichthyologists and Herpetologists. At the University of South Dakota, she received the President's Award for Research Excellence, the Cutler award for teaching excellence, and the President's Award for Innovation and Entrepreneurship.

The NSF National Ecological Observatory Network Enables the Ecosystem Big Picture

Abstract. The National Ecological Observatory Network (NEON) is a large facility research infrastructure project funded by the National Science Foundation (NSF) that is designed to collect long-term (30-year) open access ecological data to better understand how U.S. ecosystems are changing. Located in 20 distinct ecoclimatic Domains with 81 field sites across the U.S. – including Alaska, Hawaii, and Puerto Rico –NEON captures a full range of data on U.S. ecological and climatic diversity. These include data from plants, animals, soil, nutrients, freshwater, and the atmosphere using automated sensor measurements and manual field observations. Remote sensing data collected using an airborne platform, can be combined with both existing satellite data and site-level observational data to support regional to continental characterization of ecological processes. Altogether, Observatory data enable synthesis of large ecological datasets at a continental scale and over decades. These will provide fundamental insights into biological responses to changing environmental conditions, land-use changes, and invasive species – all vital knowledge needed for decision-making.

Dr. Sarah Hobbie

Distinguished McKnight University Professor, Department of Ecology, Evolution and Behavior, University of Minnesota

Dr. Sarah Hobbie is Distinguished McKnight University Professor in the Department of Ecology, Evolution and Behavior. Her research focuses on the influence of changes in atmospheric composition, climate, and land use on communities and ecosystems, and on the effects of urbanization on biodiversity and water quality. She leads the new Minneapolis-St. Paul Metropolitan Area Long Term Ecological Research program, focused on understanding interactions between people and nature in the Twin Cities. She is a member of the National Academy of Sciences and a Fellow of the American Academy of Arts and Sciences. She serves on the Advisory Board of the Earth Leadership Program and on several editorial boards.

Integrating Diverse Data to Address Environmental Injustices in Cities

Abstract. Urban nature, such as parks, yards, gardens, lakes, and streams, provide a host of potential benefits for city residents. But urban nature is subject to myriad unique stressors that may impact ecological communities and impair their capacity to provide benefits to urban residents. Furthermore, the benefits and burdens of urban nature are not felt equally by all urban residents, with white and otherwise privileged communities experiencing the greatest, and Black, Indigenous, and People of Color (BIPOC)

experiencing the least benefits. The new Minneapolis-St. Paul Urban Long-Term Ecological Research program (encompassing the seven-county Minneapolis-St. Paul, Minnesota metropolitan area) is integrating diverse data sets to illuminate the dynamic and varied relationships between urban nature and people, towards better understanding how the urban ecosystem is changing in the face of rapid environmental and social change, and to inform approaches for improving environmental outcomes for all residents. Here I highlight ongoing and proposed research to illustrate how ecological and social data from diverse sources, across spatial scales from individual trees to satellites, can be used to understand variation in canopy cover, diversity, and resilience of the urban forest in the face of climate change and pests and pathogens. Further, I highlight how ecological data on urban forests and other kinds of urban nature can be integrated with social data, including census data and spatially explicit data on racially discriminatory lending practices, to better understand potential injustices in urban nature investments and benefits. This work highlights the need for continued investments in long-term urban ecological and social data collection at multiple scales, from local to continental, as well as for resources to support synthesis and integration of diverse data sets, towards improving environmental outcomes for all urban residents.

ABOUT AERC

The Association of Ecosystem Research Centers (AERC) aims to support and encourage cooperation in research and training among ecosystem centers; strengthen ecosystem research and its applications; and advance understanding of ecosystem science at local, regional, national and international levels.

AERC brings together a network of U.S. research programs in universities and private, state and federal laboratories that conduct research, provide training and analyze policy at the ecosystem level of environmental science and natural resources management. These centers are located throughout the U.S. mainland, as well as Alaska and Puerto Rico. These organizations conduct a major share of the ecosystem research in the United States and represent hundreds of scientists. Together these scientists conduct a major share of the ecosystem research in the United States.

The major environmental and natural-resources problems facing the earth - global climatic change, declining biodiversity, spreading surface and groundwater pollution, acid precipitation, desertification, declining fisheries - are so extensive that they can only be addressed on a regional, continental, or global scale, and with a broadly coordinated interdisciplinary focus. Such scales and focus imply the need for extensive communication; and for exchange of views and collaboration on research, training, and policy needs.

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