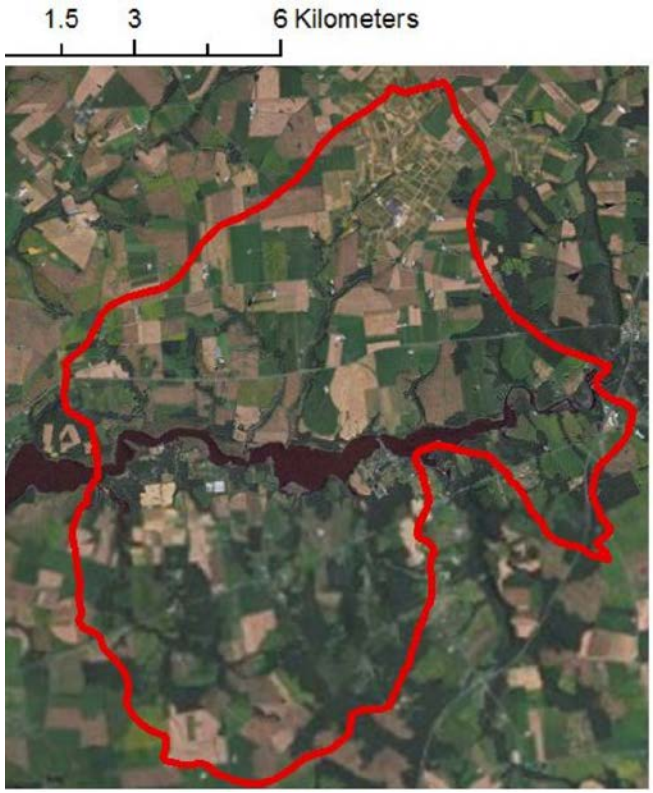

We prepare engineers for careers in the interdisciplinary field of environmental and water resources engineering. My research focuses on the development of techniques for effective water resources management. The challenges that we are addressing include nutrient management for complex watershed-stream- aquifer systems, sustainable stormwater designs, and integration of public health and livelihood maintenance into reservoir operations. We have worked collaboratively with water resource managers at the local, state, federal, and international levels, applying our research to their water resource concerns. I am an active participant in the department's Department of Education supported initiative in developing future faculty members with expertise in resilient infrastructure systems.

Environmental & Water Resources Group

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"Effective and sustainable water resources management"

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Computational Modeling of Integrated Groundwater Systems

Coastal aquifers are critical resources that are threatened from inputs of agricultural chemicals, over-development, and climate change. Computational models are important tools to facilitate sustainable management of these coastal aquifer systems. While nutrient transformations occur at the surface, in vegetation and soils, in groundwater and in the hyporheic layer under streams, management models do not integrate these systems and the biogeochemical reactions within them. We are investigating the impacts that simplifications in the complexity of nutrient transport and transformation have on the accuracy of regional nutrient management models and the extent to which these simplifications could impact the efficacy of regional nutrient management programs, such as water quality trading. We are also exploring how installation of water quality sensors in streams can inform the management of these systems.

Sustainable Stormwater Management

Increased imperviousness from urbanization alters the natural hydrology, resulting in increased volume and rate of surface runoff, decreased groundwater recharge and stream flow, increased frequency and severity of local flooding. These impacts often lead to decreased water quality in receiving streams, which detrimentally affects the receiving aquatic systems. It is widely recognized that we need green development that protects and restores hydrologic functions. We are developing innovative stormwater best management practices (BMPs) and monitoring their performance. We are investigating the reuse of waste materials, like wood chips and iron shavings, to enrich soil media and enhance removal of nutrients from wastewater. We are also applying smart cities technology to stormwater systems, developing the use of sensors and controllable valves to maximize the ability of BMPs to control flooding and reduce pollution.

Operation of Multi-purpose Reservoirs

Globally we are in a period of rapid construction of reservoirs. In addition to the intended purposes of water supply, flood control and power generation, reservoirs can also have substantial negative ecological and social impacts. For instance, ponded water within a reservoir may enhance the habitat for malaria vectors, and the reservoir footprint often disrupts agricultural livelihoods. We are seeking to directly address and mitigate these side effects by working with local stakeholders to identify feasible livelihood alternatives and by development and testing of alternative reservoir release protocols.

RECENT RESEARCH DEVELOPMENTS

- Developed a simple, alternative design paradigm to specify the size and location of outlets from a stormwater pond that helps restore the natural ecological downstream flows.
- Devised a malaria-management reservoir release rule and demonstrated that reservoir-enhanced malaria could be controlled without detriment to hydropower production in subtropical Ethiopia and that this control approach is still feasible under potential climate change scenarios.

RECENT GRANTS

- Mid-Atlantic Transportation Sustainability Center – Removing Nitrate from Stormwater with Biochar in Roadway Soils
- Department of Education – Resilient Infrastructure: Designing America's Future

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