OLD DOMINION UNIVERSITY

Center for Coastal Physical Oceanography

Fall 2023 Virtual Seminar Series

Title	"Urban Forests for Flood Reduction"
Speaker	Daniel McLaughlin, Virginia Tech
Date	Monday, October 30, 2023
Time	3:30 PM EST

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Abstract To inform urban forest conservation for flood protection, our Virginia Tech research team, in collaboration with the City of Virginia Beach and The Nature Conservancy, quantified water storage and water removal services across the City of Virginia Beach. These services were determined and compared across different land covers, including various forest types, low- to high-intensity urban, and agricultural areas. Water storage capacity in soils and depressions was estimated using publicly available data for soil characteristics, groundwater levels, and land surface elevations. Values for water removal through evapotranspiration (ET) were obtained using 18 years of satellite imagery data, which were processed to estimate annual ET values across the City. We found that the City's upland forests, generally situated in higher elevation areas with better drained soils, have among the highest average values for soil water storage. While their relative contribution to the City's overall water storage is limited due to a small extent (5% of total land area), localized blocks of upland forest could be of critical flood-reduction value for specific developed areas. The study also revealed that wetland forests, the dominant forest cover in Virginia Beach, have the highest ET rates among all land cover classes (roughly 3-4 times that of urban areas). Indeed, wetland forests contribute approximately 40% of all ET across land areas of Virginia Beach despite the fact they only occupy 20% of total land area. In total, forest cover in Virginia Beach contributes approximately 23% of the City's water storage capacity and 45% of its water removal potential. Thus, conversion of forest cover to urban use would likely result in dramatic changes to the magnitude and frequency of flood events. In addition to highlighting this potential consequence of forest loss, the study also points to the benefit of forest restoration. For example, open space in developed areas of the City (approximately 16% of the total City area) also has high soil water storage capacity. Incorporating forest cover into these open space areas would likely

increase ET (and thus removal of stored soil water), enhancing the flood reduction potential of this land cover type. With these data, new efforts are now ongoing to incorporate forests and their flood reduction features into stormwater management models, which can be used to quantify the contribution of forest cover to flood reduction under different storm event scenarios. This modeling is critical for identifying the most important forest blocks to conserve to meet flood reduction goals and to inform green infrastructure planning within broader stormwater management efforts.

Biography

Dr. Daniel McLaughlin is an associate professor in the College of Natural Resources and Environment at Virginia Tech. His research integrates hydrological and ecological processes and includes interests in watershed hydrology, forested ecosystems, and wetland and stream processes. His research spans systems and scales to better understand abiotic and biotic drivers of ecosystem function and is broadly focused on informing water resource management. Dr. McLaughlin's current teaching responsibilities include graduate and undergraduate courses in Wetland Hydrology and Biogeochemistry and Watershed and Water Quality Monitoring. He has a Ph.D. in Systems Ecology and Ecological Engineering from the University of Florida, a M.S. in Environmental Engineering from Clemson University, and a B.S. in Civil Engineering from Clemson University.