A new Bimonthly seminar series from the Department of Civil and Environmental Engineering (CEE), focusing on convergent research, bringing together Northeastern colleagues and collaborators to think big/bold, explore ideas that build cooperation and foster transformative innovation within CEE and across disciplines beyond CEE.

Dan Cox, PhD

CH2M-Hill Professor in Civil Engineering,

Oregon State University

Friday

May 12, 2023

12pm–1pm

SH 415

Prototype-Scale Laboratory Tests of Wave Damping by Mangroves and Implication to the Design of Nature-based Solutions

Abstract: *As coastal communities search for effective, resilient adaptation strategies to coastal hazards including sea level rise, erosion, and storm-driven wave and surge events, natural and nature-based systems have gained attention for their ecological, social, and engineering benefits. Wave damping by vegetation has been included in many numerical models for coastal engineering primarily through a parameterized expression for the wave height decay following Mendez and Losada (2004). This formulation uses an empirical drag coefficient often derived from reduced-scale laboratory experiments and parameterized in terms of a Reynolds number of Keulegan-Carpenter number. However, it is well-known that Reynolds similitude cannot be held between model and prototype when Froude similitude is applied. This disparity raises a fundamental scaling issue: Are drag coefficients obtained by reduced-scale experiments of wave damping by vegetation suitable for engineering design? To address this, we conducted prototype-scale laboratory tests of wave damping for an idealized mangrove forest of moderate cross-shore width (Kelty et al., 2022) and compared results to two reduced-scale tests conducted independently by other researchers. We present our prototype-scale tests, the quantification of the complex, simulated mangrove root structure using LiDAR, the uncertainty quantification of empirical coefficients for these tests, data archive and open access, and propose the scaling relation for future tests. The implication of the use of unscaled and re-scaled damping coefficients for models like XBeach will be presented and discussed in the context of coastal engineering design. The remainder of the presentation will be to discuss future efforts of a Manual of Practice to accelerate the use of engineering with nature for coastal hazard mitigation.*

Bio: *Dr. Daniel Cox is the CH2M-Hill Professor in Civil Engineering at Oregon State University. Dr. Cox's research focuses on community resilience to coastal hazards, including tsunami and hurricane surge and waves inundation in the built and natural environments. He conducts research on tsunami and wave impacts on near-coast structures, tsunami evacuation and life safety, sediment transport and erosion, and nature-based solutions for coastal hazards mitigation. He is the lead Principle Investigator for the NSF Natural Hazards Engineering Research Infrastructure (NHERI) shared-used facility for coastal surge, wave and tsunami physical model testing at the O.H. Hinsdale Wave Research Laboratory, and he is a member of the NIST funded Center of Excellence for Community Resilience to develop the open-source Interdependent Networked-Community Resilience Modeling Environment (IN-CORE). He is an active member of ASCE, serving as chair of the ASCE 7 Standard, Flood Load Subcommittee and as chair of the ASCE 24 Standard for flood resistant design.*