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– Ashley Helton

Urban wetlands on the edge – a salty conversation

by Peg Van Patten

Coastal wetlands are literally at the edge of sea level rise, as the changing interface between land and sea. As sea level continues to rise, it is more important than ever to have resilient wetlands that will serve not only in providing essential productive wildlife habitat, but also in buffering storms from inland communities, removing water contaminants, storing carbon, and other important functions. However, those peaceful looking grassy wetlands and their inhabitants are in an epic struggle to maintain stability and survive. The formidable, even inexorable, opponents are sea level rise, coastal flooding and erosion from storms, and the effects of adjacent land development.

Some marshes are able to migrate landward, depending on elevation, development, and other factors. Globally, some researchers estimate that as much as four-fifths of the world's wetlands are at risk of disappearing. Sea-level rise is predicted to threaten 50 to 97% of high marsh habitat in Connecticut by the year 2100.

Ashley Helton, assistant professor of Natural Resources and Environment at University of Connecticut (UConn), asked how we can identify which wetlands are capable of performing the most critical functions, and which are most susceptible to increased salinity. Little is known how wetland ecosystem functions are changing under the conditions of both urban development and saltwater intrusion from sea level rise. Finding answers would make it easier to identify target wetlands for restoration. Partnering with Timothy Vadas, assistant professor of UConn Civil and Environmental Engineering, she was successful in getting Sea Grant to support a research project initiated in 2014.

With the help of April Doroski, an enthusiastic UConn graduate student (featured on our cover), Mary Zawatski, an undergraduate student in Environmental Science at UConn, and two high school students in community

projects for the Natural Resources Conservation Academy, they set out to find out answers. The approach uses geospatial information, field surveys, and lab experiments to investigate restored and reference tidal wetlands across a salinity gradient. In 2015 they sampled soil in 32 coastal wetlands (restored and reference) in Connecticut with varying salinity and levels of contaminants from nearby urban areas.

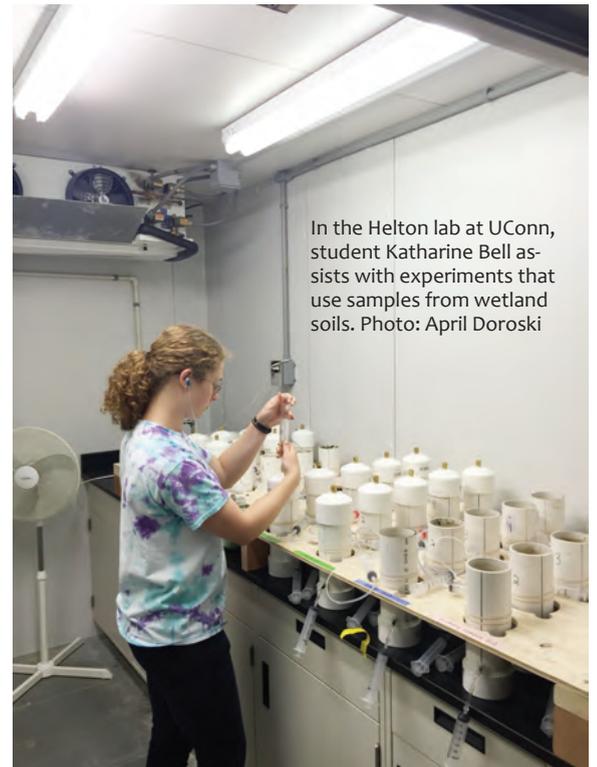
Naturally, each wetland is unique, and each has its own set of conditions, characteristics, and challenges. The team focused on the wetlands' ability to convert reactive nitrogen and retain certain common urban metal contaminants (copper, lead, and zinc) as primary ecosystem functions.

“When wetlands have the capacity to retain these metals and nutrients, downstream water quality will likely improve,” said Helton, “At the same time, these wetlands may be particularly sensitive to saltwater inundation in urban landscapes, and we need to know how that works.”

The team took the samples back to the lab, and analyzed them for denitrification (a process in which microbes convert reactive nitrogen to atmospheric gas), soil nitrogen content, salinity, metal content, and chemical properties that indicate the measure of a soil's capacity to retain metals and nutrients. They measured several other parameters such as pH, carbon mineralization, and organic matter content, Doroski said.

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The results from the 2015 field survey aided in planning the ensuing experiment this year in which Doroski applied variations of



In the Helton lab at UConn, student Katharine Bell assists with experiments that use samples from wetland soils. Photo: April Doroski

saltwater and runoff treatments to soil cores collected from a freshwater wetland.

“The goal of our experiment was to disentangle the effects of both runoff and saltwater intrusion on freshwater wetland ecosystem functions like greenhouse gas emissions,” Doroski explains. Preliminary results indicate increasing nitrous oxide emissions in soil cores receiving saltwater treatments. This suggests saltwater intrusion may increase greenhouse gas emission of nitrous oxide, which has a global warming potential 298 times that of carbon dioxide.

With field survey and experimental data combined, Doroski and Helton hope to better identify how coastal wetlands will respond to rising sea level, especially in urban landscapes. This information can be useful for land managers and agencies interested restoring or protecting wetlands to improve downstream water quality or balance greenhouse gas emissions, while also taking into account effects of sea level rise.