Scientists replicate the tide with two buckets, aquarium tubing, and a pump

October 31 2014

Rachel MacTavish is growing salt marsh plants in microcosms that replicate the tide. She assembled them in an outdoor greenhouse at the Sapelo Island National Estuarine Research Reserve in Georgia, USA, with buckets from a hardware store, aquarium tubing, and pumps. Her tidal simulation units could be an important tool for preserving and restoring environmentally important wetlands, because they enable researchers to investigate tidal marsh plant growth in a controlled setting.

"Tidal wetlands are often influenced by many factors, and controlled experiments allow researchers to isolate and untangle the roles of individual variables," explains MacTavish, a graduate student in the Department of Biology at Georgia Southern University. "I was inspired to construct and test this tidal simulation method as a way to examine the effects of added nutrients and salt in the water on salt marsh plant nutrient uptake."

The design by MacTavish and coauthor Dr. Risa A. Cohen opens new doors for wetland research by overcoming limitations of previously developed tidal simulators. Each unit costs less than US$27.00, takes up less than two square feet of space, and does not rely on any external plumbing.

The simulators also support plant growth as well as real tidal flushing. MacTavish and Cohen compared the growth of the tidal cordgrass *Spartina alterniflora* in field sites and microcosm units. Their results indicated no significant difference in height, stem density, or above- and

belowground biomass between the natural and simulated tidal treatments. The new tidal simulator protocol and the comparison of *S. alterniflora* growth in real tidal conditions versus the simulator are published in the November issue of *Applications in Plant Sciences*.

"Salt marshes have incredible value, protecting coastal populations from high wave energy during storms, sequestering large amounts of carbon, and serving as nursery habitat for many commercially important fishes," explains MacTavish. "They are extremely productive ecosystems, providing nutrients and organic carbon to nearby coastal waters and beaches."

Oil spills, heavy metals, and other sorts of water pollution continuously threaten tidal ecosystems. This new and simple mechanism to simulate the tide will enable researchers everywhere to uncover solutions to these and other hazards.

"I'm already using [the tidal simulator] in one of my experiments to study the concurrent effects of altered water column ammonium and salinity on *S. alterniflora* nitrogen uptake," says MacTavish. "Another colleague at Georgia Southern University is also using it to examine the effects of sediment amendments on *S. alterniflora* growth under different soil organic matter concentrations to improve salt marsh restoration strategies."

More information: Rachel M. MacTavish and Risa A. Cohen. A simple, inexpensive, and field-relevant microcosm tidal simulator for use in marsh macrophyte studies. *Applications in Plant Sciences* 2(11): 1400058. DOI: 10.3732/apps.1400058

Provided by American Journal of Botany

Citation: Scientists replicate the tide with two buckets, aquarium tubing, and a pump (2014, October 31) retrieved 25 April 2024 from https://phys.org/news/2014-10-scientists-replicate-tide-buckets-aquarium.html

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