Hixon Center for Urban Ecology

Student Research Fellows

Material Exchange Between an Urban Salt Marsh and Long Island Sound

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Problem

Salt marshes in urban environments face intense anthropogenic pressures. Coastal development limits opportunities for inland marsh migration, and shoreline stabilization can reduce sediment supply and limit vertical accretion of the marsh; two critical mechanisms by which marshes accommodate rising sea levels. This study reports fluxes of water, salt, and sediment between an urban salt marsh and Long Island Sound. It examines the role of storm events in driving sediment transport, and couples ecosystem-scale sediment flux data with sediment traps deployed on the marsh platform, to evaluate both sediment supply and deposition.

Research questions

(1) On time scales of individual tides, are urban marshes sinks or sources of sediment?

(2) Do storm events provide pulses of inorganic sediment into the marsh, or rinse sediment out of the marsh?

(3) Do sediment flux data at the ecosystem scale agree with estimates of sedimentation on the vegetated marsh surface?

Figure 1. Harborview marsh in Norwalk, CT. Instrumentation and sampling plots are indicated.

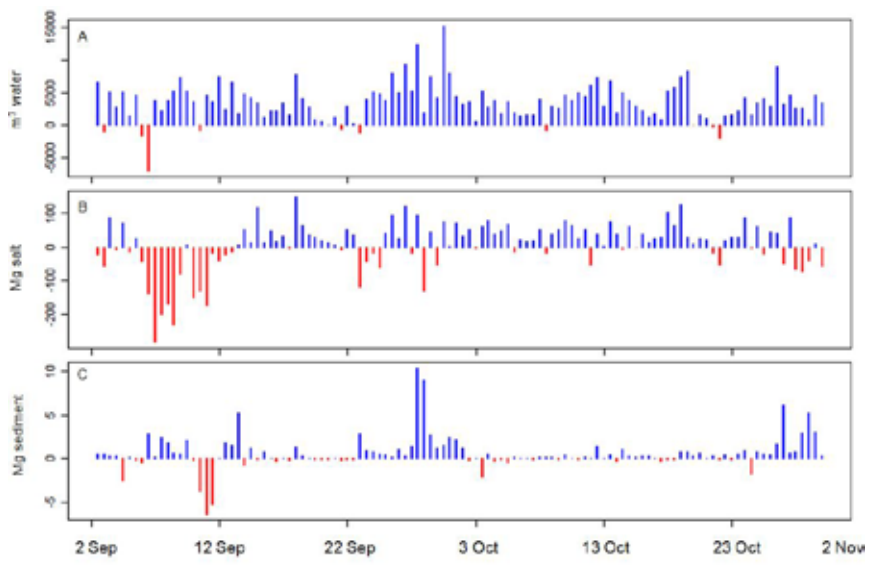

Figure 2. Net flux of water (panel A), salt (panel B), and sediment (panel C) over tidal cycles. Positive values, shown in blue, reflect net import to the marsh over a tidal cycle; negative values are export.

Methods

- Continuously monitored water discharge at the inlet to a Long Island Sound salt marsh
- Continuously measured turbidity and salinity in tidal waters, and local precipitation
- An empirical relationship between turbidity and suspended sediment concentration (SSC) was established, allowing continuous data on sediment transport
- Measured sediment deposition on the marsh platform using sediment traps
- Mass balances of water and salt were used to evaluate the uncertainty in sediment flux estimates
- Trace metals in seawater were experimentally measured using resin columns to explore minor constituent fluxes

Discussion

- On average, 4 Mg of sediment moves in and out of the marsh with each tidal cycle
- The ecosystem is characterized by a dramatic level of flashiness, oscillating between net influxes and net effluxes of sediment
- Over the study period, sediment inflow and outflow from the marsh were approximately balanced
- Storm events have a range of effects on the marsh
  - > Storms increase average tidal import of sediment by a factor of four ($p < 0.05$)
  - > As storm magnitude increases, so does the magnitude of net sediment influx ($p < 0.05$)
- Sediment accumulation over the entire vegetated portion of the marsh was approximately ~5 kg per tide during the period of study
- Mud flat sediment dynamics are important to reconciling sediment flux at different spatial scales within this ecosystem

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