Ecomorphodynamics of salt marsh and mudflat systems in the Upper Bay of Fundy

Danika van Proosdij
Department of Geography, Saint Mary's University, 923 Robie St., Halifax, NS, B0J 1T0 <dvanproo@smu.ca>

'Ecomorphodynamics' refers to the study of the interaction and adjustment of topography, vegetation, fluid and hydrodynamic processes, morphologies and sequence of change dynamics involving the movement of sediment. These feedbacks are clearly evident within the vast intertidal ecosystems located in the Bay of Fundy. Salt marshes and mudflats represent delicately balanced systems between hydrodynamic forces and ecological, sedimentological and morphological responses. Changes in marsh or mudflat surface elevation within the tidal frame or changes in edge morphology will in turn induce changes in tidal prism, hydrodynamic forces, vegetation community structure, rates of sedimentation and dissipation (marsh platform) or amplification (cliff) of wave energy. The rate of these changes can be significantly influenced by human development such as the construction of tidal barriers or installation of shore protection.

This presentation will examine our current understanding of the sedimentary processes operating within salt marsh and mudflat systems in the Upper Bay of Fundy. It will focus on the integration of meso-scale (decadal/basin wide) quantification of geomorphic changes in the intertidal zone using ArcGIS with micro-scale (seasonal to tidal cycle/marsh level) investigations of the relative and seasonal contributions of biophysical variables controling sediment accretion and erosion within salt marshes and mudflats of this region. Examples will be drawn from research conducted within the Cumberland and Minas basins over the last decade. In addition, potential forcing functions controling the ecomorphodynamics and overall evolution and resilience of macrotidal intertidal systems will be explored. These include tidal height, wave climate, tidal channel location, winter conditions, dyking history and engineering structures. Several key observations will be highlighted, namely the importance of waves and ice in controling and initiating vegetative growth as well as the highly variable and cyclic nature, both in time and space of intertidal geomorphology in the Upper Bay. Fundy salt marshes undergo cycles of progradation and erosion similar to marshes studied elsewhere (e.g., Europe). Mudflat elevations may vary by as much as several meters within one year, returning to the same base level in the spring and are highly dependant on the position of the main tidal channel thalweg. An accurate assessment of the response of these systems to change (e.g., causeway construction or rising sea levels) and the development of valid hydrodynamic models to predict changes in the future requires these systems to be studied at both large and fine spatial and temporal scales. Too often management decisions are made based on spatially limited (e.g., one site) and temporally restrictive (e.g., one season) data. Despite a flurry of research into salt marsh and mudflat processes over the last decade, major research questions remain. These include: quantifying the winter contribution to the overall sediment budget; modeling sediment dynamics (e.g., sediment flux) and wave climate within the inner estuaries of the Upper Bay; determining the cumulative impact of small (e.g., aboiteau) versus large (e.g., causeway) barriers on intertidal geomorphology and how these ecosystems will respond to the removal of tidal barriers both large (e.g., Petitcodiac) or small (e.g., Cheverie).