

Sea-Level Rise and Salt Marsh Restoration in the Bay of Fundy: Two Case Studies

Jeff Ollerhead

Mount Allison University

The Issue

- The climate in Maritime Canada is changing and sea level is rising at 0.3 to 0.4 cm/a
 - the rate of sea-level rise will almost certainly double by the end of this century
- Large tracts of land in the region are protected from salt water inundation by dykes, including freshwater sources

The Issue

- As our environment changes, there will be two options for us to consider
 - adapt by raising and reinforcing the dykes
 - adapt by restoring dyked lands to salt marsh
- Raising and reinforcing dykes will become progressively more expensive as time goes on and dykes cannot self-adapt to ongoing changes in climate and sea level like salt marshes can

Presentation Objectives

- To evaluate the technical (geomorphic) feasibility of converting dyked lands to salt marsh in Maritime Canada as an adaptation strategy to future climate change (CC) and sea level rise (SLR)
- To present two case studies of restoration projects.

Upper Bay of Fundy

- Tidal range is ~ 14 m
- A shallow sub-tidal zone occupies ~ 1/3 of the Basin while the remainder consists of mud and sand flats with salt marshes occupying the upper inter-tidal zone
- Suspended sediment concentration is generally high (mean is ~ $0.3 \text{ g}\cdot\text{l}^{-1}$)
- Ice and snow are a seasonal factor



11.09.2008

Salt Marsh Restoration as an Adaptation to CC and SLR

- Salt Marshes
 - are self regulating
 - absorb wave energy rather than reflect it
 - provide a wide buffer
 - do not fail catastrophically



Peck's Cove



Fort Beauséjour



Westcock

Kostaschuk et al. (2008)

- Studied the Allen Creek salt marsh
- Pb-210 & Cs-137 along with AMS dating indicate a sedimentation rate of ~ 1.1 cm/a
 - These results are consistent with our other work at this marsh
- This rate is more than sufficient to keep pace with RSL rise

So...

- The dominant controls on marsh growth in Fundy appear to be
 - high rates of vertical marsh accretion due to the high suspended sediment load in the Bay
 - exposure to wave action
 - effects of ice & vegetation

So...

- Conditions in the Bay of Fundy are favourable for salt marsh restoration
- A pilot restoration was tried at Musquash, NB starting in 2005





Early Spring, 2005



Mid Fall, 2006

Success of Musquah Restoration?


- The restored marsh is growing vertically at ~ 2 cm/a (twice the rate of natural marshes in the area)
- Drainage system has re-established and there is 100% tidal flooding at spring high tide
- Vegetation has re-established rapidly and the rail bed is now almost 'gone'

Aulac Restoration

- A new restoration was started near Aulac, NB in the fall of 2010
- The project took over 2 years to plan
- The success of this project cannot be determined yet but early signs are promising


Beauséjour Restoration Site



 opening

access road



0 100 200
 Metres

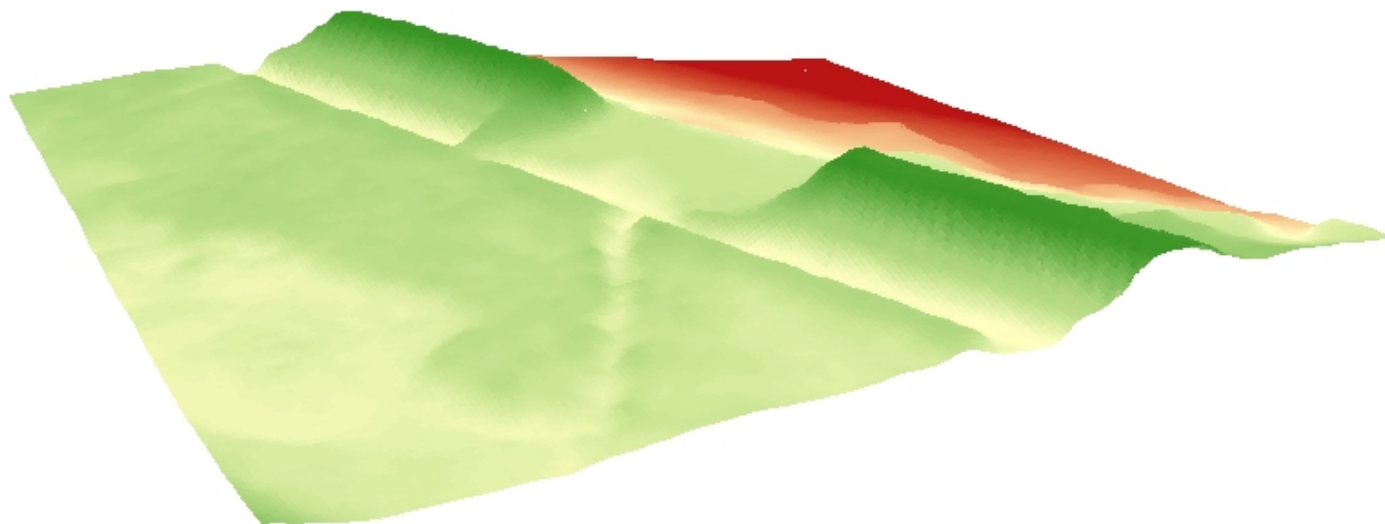




Tools for Healthy Watersheds (2011)



Tools for Healthy Watersheds (2011)



Conclusions

- There are no significant geomorphic issues with using salt marsh restoration as an adaptation to CC and SLR
- There is more than enough sediment in the Bay of Fundy to allow for this strategy
- Pilot restorations have been successful

Conclusions

- So technically – we are ready to use salt marsh restoration as an adaptation to CC and SLR (the science supports this)
- Socially and Economically – we are not ready!

Acknowledgements

- Robin Davidson-Arnott (U of G) and Danika van Proosdij (SMU)
- Cindy Spicer and Rhiana Bams (MACWI)
- Brian Sanderson
- Wade Lewis and Jana Cheverie (DUC)
- Tony Bowron et al. (CBWES Inc.)
- Tim Webster et al. (COGS)
- Funding from DUC, Fed. & Prov. Govts.