Jun 25th, 10:40 AM - 12:00 PM

Dynamic analysis of shoreline management to improve coastal resilience

Emma M. Cutler
emma.m.cutler.th@dartmouth.edu

Mary R. Albert
Dartmouth College, mary.r.albert@dartmouth.edu

Kathleen D. White
United States Army Corps of Engineers, kathleen.d.white@usace.army.mil

iEMSs International Congress on Environmental Modelling and Software

9th International Congress on Environmental Modelling and Software
Fort Collins, Colorado, USA, Mazdak Arabi, Olaf David, Jack Carlson, Daniel P. Ames (Eds.)
https://scholarsarchive.byu.edu/iemssconference/2018/

Dynamic Analysis of Shoreline Management to Improve Coastal Resilience

Emma M. Cutler[1], Mary R. Albert[1], Kathleen D. White[2]
[1]*Thayer School of Engineering, Dartmouth College, Hanover, New Hampshire 03755 USA; emma.m.cutler.th@dartmouth.edu, mary.r.albert@dartmouth.edu*
United States Army Corps of Engineers, Headquarters, Engineering, and Construction, Washington, DC 20314 USA; kathleen.d.white@usace.army.mil

Abstract: Beach nourishment, the process of transporting sand, often from off-shore locations, to create wide, sandy beaches that can reduce flood damages, is one of the most common risk reduction strategies for developed coastlines in the United States. However, due to continued erosion, exacerbated by sea level rise, nourishment is a temporary solution. Thus, long-term beach nourishment projects require periodic input of money and sand, both of which may be limited resources. Additionally, previous research has shown the possibility of a positive feedback between coastal development and beach nourishment. This implies that beach nourishment as a coastal risk mitigation strategy could rebound or even backfire due to increased development. This positive feedback also suggests that nourishing now could increase demand for nourishment in the future. Multiple economic studies of beach nourishment have concluded that benefits outweigh costs in some contexts. However, these studies typically do not include feedbacks between coastal development and beach nourishment and do not always consider sea level rise. Here, a dynamic modeling study examines how subsidies may increase dependence on unsustainable beach nourishment practices. Building off of existing dynamic optimization models, we model the costs and benefits of nourishment, allowing for non-stationarity in sea level and feedbacks with coastal development. The model reveals perverse incentives that exist within coastal management practices, and it provides a framework that accounts for these unintended consequences in decision-making processes with the goal of improving long-term resilience to flooding and sea level rise along developed coastlines.

***Keywords**:* beach nourishment; perverse incentives; coastal management; cost benefit analysis