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

Follow this and additional works at: https://scholarsarchive.byu.edu/iemssconference

Cutler, Emma M.; Albert, Mary R.; and White, Kathleen D., "Dynamic analysis of shoreline management to improve coastal resilience" (2018). International Congress on Environmental Modelling and Software. 115,  
https://scholarsarchive.byu.edu/iemssconference/2018/Stream-C/115

This Oral Presentation (in session) is brought to you for free and open access by the Civil and Environmental Engineering at BYU ScholarsArchive. It has been accepted for inclusion in International Congress on Environmental Modelling and Software by an authorized administrator of BYU ScholarsArchive. For more information, please contact scholarsarchive@byu.edu, ellen_amatangelo@byu.edu.
Dynamic Analysis of Shoreline Management to Improve Coastal Resilience

Emma M. Cutler¹, Mary R. Albert¹, Kathleen D. White²
¹Thayer School of Engineering, Dartmouth College, Hanover, New Hampshire 03755 USA; emma.m.cutler.th@dartmouth.edu, mary.r.albert@dartmouth.edu
²United 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