Beach Grass Invasions and Coastal Flood Protection: Forecasting the Effects of Climate Change on Coastal Vulnerability

Eric Seabloom, Sally Hacker, and Peter Ruggiero
Oregon State University, Corvallis, OR

Increased storm severity and sea-level rise resulting from climate change have greatly elevated the risk of catastrophic flooding and storm damage to coastal communities. These risks have been exacerbated by alterations to coastal ecosystems and the introduction of exotic species. In the Pacific Northwest, coastal dunes protect approximately one-half of the coastline, and our initial results suggest that climate change-induced sea level rise could double the frequency with which waves overtop dunes. Intentional planting of exotic grasses may have initially increased coastal protection from flooding by building tall foredunes parallel to the shoreline. However, an unintentional second invasion appears to be decreasing foredune height by 50 percent, thereby increasing risk exposure. In addition, many agencies are removing exotic beach grasses to restore habitat for imperiled species listed in the Endangered Species Act. The effects of these conservation actions on flooding risk are unknown. The objectives of this research are to determine: (1) the effects of climate change on exotic beach grass invasion; (2) the effects of exotic beach grass invasion on coastal vulnerability; and (3) if conservation management alters coastal vulnerability to flooding under a range of climate change, invasion, and management scenarios.

The investigators will use published climate change scenarios, remotely sensed beach topography data (LIDAR), and field experimentation to parameterize coastal process and vulnerability models. These empirically parameterized models will be used to forecast the risk of flooding in coastal communities under a range of climate change and invasion scenarios.

This research will yield an increased general understanding of interactions among the alteration of coastal ecosystems, species invasions, climate change, and human risk in coastal environments. In addition, the researchers will conduct a quantitative vulnerability assessment of a specific coastal community in Washington. This case study will serve as a template for other applications of our models and data in coastal dune systems worldwide.

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