National Institute of Environmental Health Sciences

Invasive grasses, climate change, and exposure to storm-wave overtopping in coastal dune ecosystems

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Year: 2013
Journal: Global Change Biology. 19 (3): 824-832

Abstract:

The world's coastal habitats are critical to human well-being, but are also highly sensitive to human habitat alterations and climate change. In particular, global climate is increasing sea levels and potentially altering storm intensities, which may result in increased risk of flooding in coastal areas. In the Pacific Northwest (USA), coastal dunes that protect the coast from flooding are largely the product of a grass introduced from Europe over a century ago (Ammophila arenaria). An introduced congener (A. breviligulata) is displacing A. arenaria and reducing dune height. Here we quantify the relative exposure to storm-wave induced dune overtopping posed by the A. breviligulata invasion in the face of projected multi-decadal changes in sea level and storm intensity. In our models, altered storm intensity was the largest driver of overtopping extent, however the invasion by A. breviligulata tripled the number of areas vulnerable to overtopping and posed a fourfold larger exposure than sea-level rise over multi-decadal time scales. Our work demonstrates the importance of a transdisciplinary approach that draws on insights from ecology, geomorphology, and civil engineering to assess the vulnerability of ecosystem services in light of global change.

Source: http://dx.doi.org/10.1111/gcb.12078

Resource Description

Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Special Report on Emissions Scenarios (SRES)

Special Report on Emissions Scenarios (SRES) Scenario: SRES A1

Exposure :

weather or climate related pathway by which climate change affects health

Ecosystem Changes, Extreme Weather Event, Sea Level Rise

Extreme Weather Event: Flooding

Geographic Feature:

resource focuses on specific type of geography

Ocean/Coastal

Geographic Location: ☒

resource focuses on specific location

United States

Health Impact: ☒

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Mitigation/Adaptation: ☒

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology: ☒

type of model used or methodology development is a focus of resource

Exposure Change Prediction, Other Projection Model/Methodology

Other Projection Model/Methodology: Shoreline Change

Resource Type: ☒

format or standard characteristic of resource

Research Article

Timescale: ☒

time period studied

Medium-Term (10-50 years)

Vulnerability/Impact Assessment: ☒

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content