



## **Assessing the Vulnerability of Infrastructure to Coastal Hazards in U.S. National Parks and Monuments**

Robert Young, Katie Peek, Blair Tormey, and Holli Thompson

Western Carolina University, Program for the Study of Developed Shorelines, Cullowhee, United States  
(ryoung@email.wcu.edu)

The Program for the Study of Developed Shorelines, in partnership with the U.S. National Park Service (NPS), has initiated an effort to conduct detailed, coastal hazard vulnerability assessments (VAs) of built assets in all national parks. The goal is to standardize the data and protocol used in the assessments, allowing managers to compare the vulnerability scores of coastal assets at local, regional, and national scales.

Interdisciplinary vulnerability assessments typically include three parts: exposure analysis (the degree to which a system will experience a stressor), sensitivity analysis (how the system fairs when exposed) and adaptive capacity analysis (the ability of the system to sustain itself by adapting to the stressor). While this formula has been successfully applied to natural or social systems, some aspects are less appropriate for application in the built environment. For example, structures cannot inherently adapt to climate change or other hazards, while natural resources often can.

The new VA protocol for the built environment includes only exposure and sensitivity in the vulnerability score. The adaptive capacity is evaluated separately, and is not included in the final vulnerability.

For the exposure analysis, relevant hazards are mapped for each asset: flooding, storm surge, sea-level rise, coastal erosion/coastal proximity, tsunami inundation, and historical flooding. Sensitivity analysis is conducted using an asset management database, federal data depositories, and direct assessment through a questionnaire completed by park staff. The overall vulnerability score is a simple combination of the exposure and sensitivity scores.

Determining adaptive strategies for key, vulnerable assets within a park is the final, and perhaps most important step. Adaptive strategies are evaluated through discussions with park personnel, park surveys, and facilitated workshops.