

National Park Facilities Adaptation to Climate Change Impacts in Coastal Areas



Hale o Keawe, Pu'uhonua O Hōnaunau National Historical Park



Bayside Picnic Area, Assateague Island National Seashore, 2012



Overview

- Context and Goals of NPS Facilities Adaptation Efforts
- 2 Pilots: Methods and Results
- Post-Sandy Analysis of Results at Assateague
- Lessons Learned



Facilities Adaptation Efforts to Date

CONTEXT AND GOALS



National Parks: A Natural and Cultural Legacy

- NPS Mission: **Preserve park resources unimpaired for future generations**
- NPS is steward of 394 park units, 23 national scenic and historic trails, and 58 wild and scenic rivers
 - More than 84 million acres of land
 - Across the entire country, nearly every state





NPS Infrastructure Supports Enjoyment of Parks

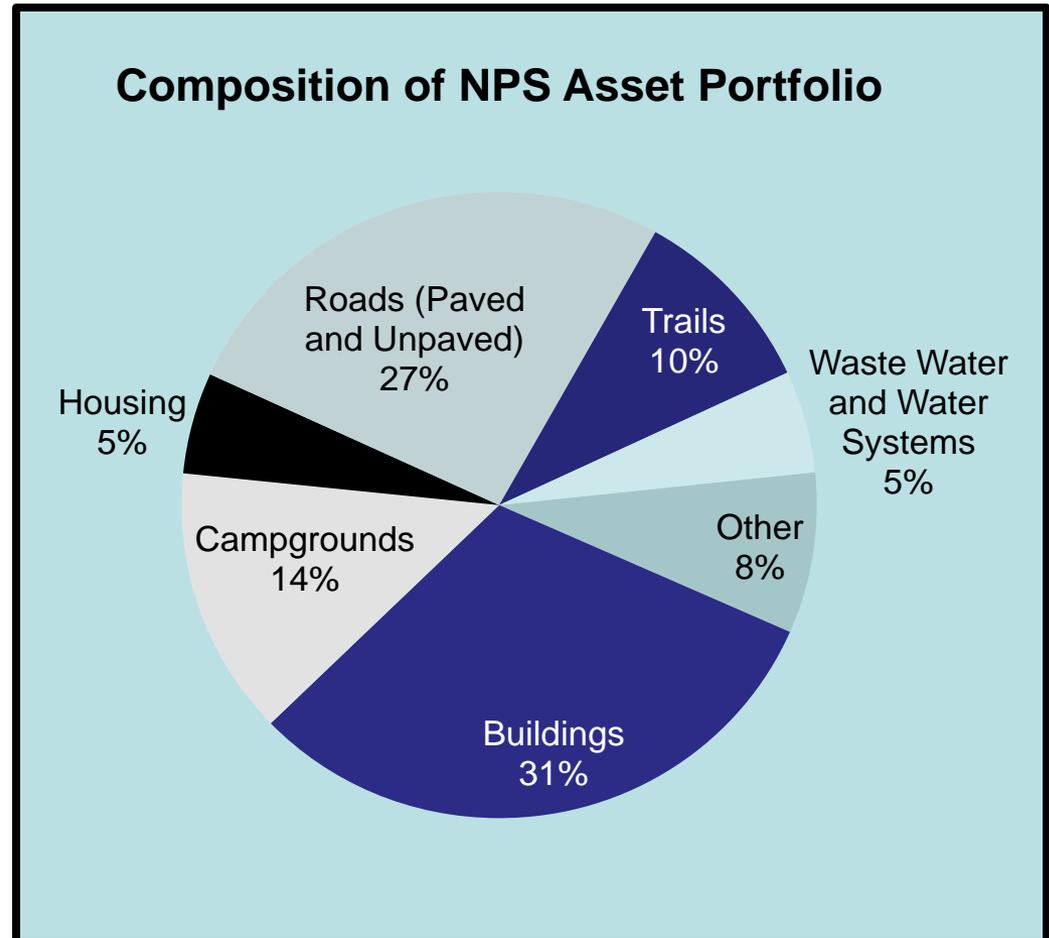
- People tend to associate national parks with natural resources
- However, NPS also oversees “built” assets and sites of extreme cultural significance
- In addition, NPS operates the infrastructure (buildings, roads, wastewater) that enable access and enjoyment of parks
- NPS currently oversees more than 88,000 assets





NPS Asset Portfolio

- NPS Portfolio
Includes more than:
 - 4,000 roads
 - 4,800 buildings
 - 2,100 campgrounds
 - 1,500 trails
 - 800 waste water and water systems





NPS Infrastructure Already Under Stress

- More visitors
- Facilities are aging
- New operational requirements
- Lack of resources
- Backlog of maintenance

**Climate change will increase stress on park facilities.
How do we adapt our facilities to ensure that access to
parks is preserved for future generations?**



Facilities Adaptation Efforts to Date

Interim Guidance on Climate Change Risk Screening, Assessment, and Management for NPS Facilities

- Provided framework for addressing climate change risks
- Completed preliminary draft January 2010

Develop high-level risk screening tool

- Developed a high-level risk screening tool to characterize vulnerability of a subset of coastal parks to sea level rise
- Completed first cut tool October 2011

Develop and pilot park- level risk screening tool

- Based on results of risk screen, chose 2 pilot parks to assess sea level rise and storm surge risk more thoroughly
- Completed tools for 2 pilots December 2012



2 PILOTS: METHODOLOGY AND RESULTS



Pu'uhonua O Honaunau National Historic Park (PUHO)

- Located on the coast of the Big Island of Hawaii
- The pu'uhonua, or place of refuge, is enclosed by the massive Great Wall that protects a sacred place for Native Hawaiians
- Most of the park's cultural resources are located below 6 feet in elevation (relative to MSL)
- These resources have been damaged during past storm events and are increasingly at risk due to sea level rise and storms

How can we manage and preserve this sacred place?





Assateague National Seashore (ASIS)

- Located on a highly dynamic barrier island
- The superintendent speculates that they have “one big move left” before all of the island’s infrastructure becomes highly susceptible to damage during tidal and storm events
- The park was hit hard by Hurricane Sandy in October 2012
- Despite (or because of) their extreme vulnerability, the Park has proven highly resilient and adaptable

How has Assateague adapted in the face of uncertainty?

What can we learn from “climate change laboratories” such as Assateague?



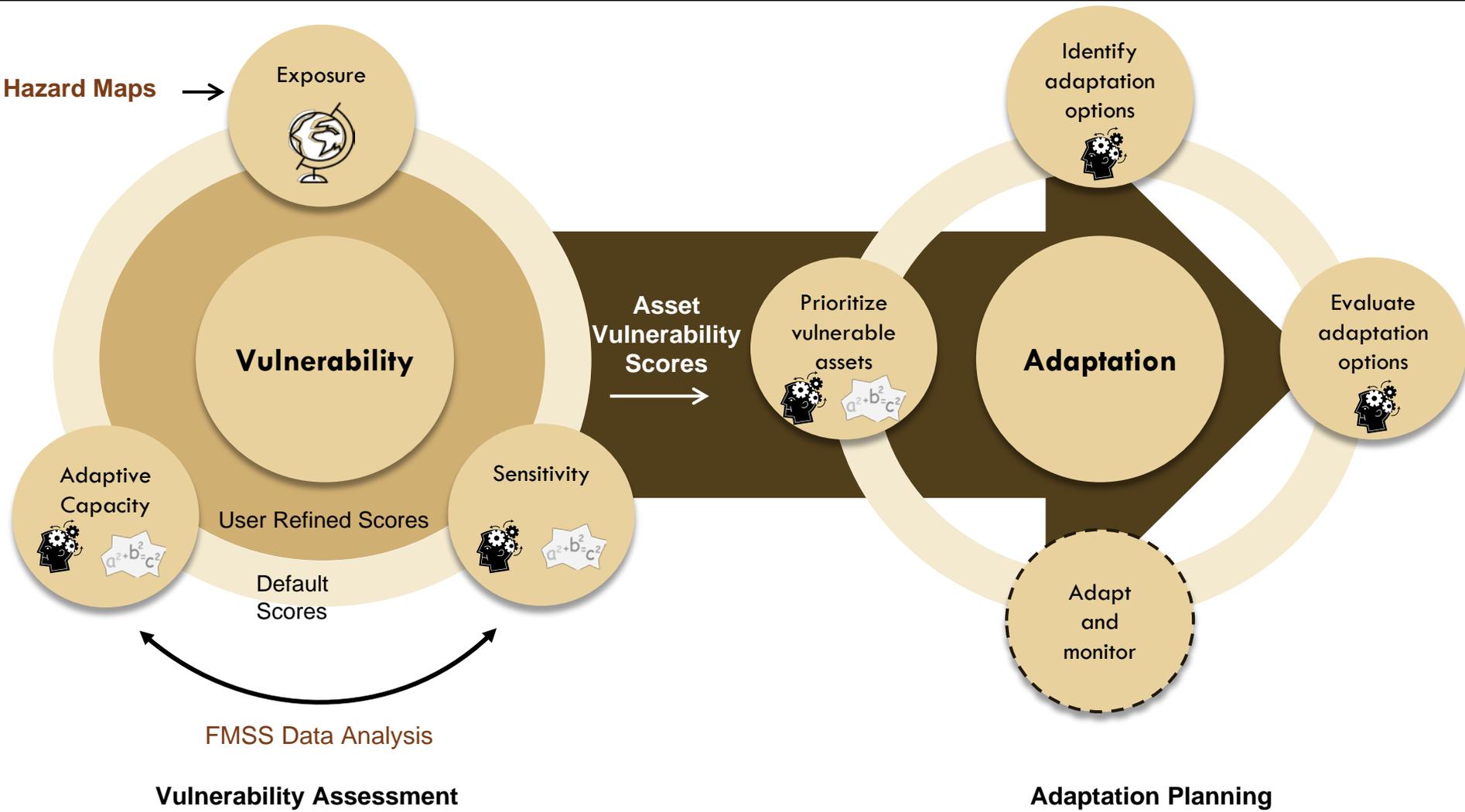


Park-Level Risk Screening Tool

- Objective 1: Better Inform Park Decision-Making
 - Provide information about which facilities are vulnerable to sea level rise and the associated costs of replacement (based on NPS Current Replacement Value (CRV) data)
- Objective 2: Develop Replicable Process and Lessons Learned
 - Identify the needs of park managers and park planners
 - Identify relevant park planning processes (site, resource, budget)
 - Identify the type of information/ data available at parks
 - Develop and test methods for applying available information to assess vulnerability



Methodology: Conceptual Framework



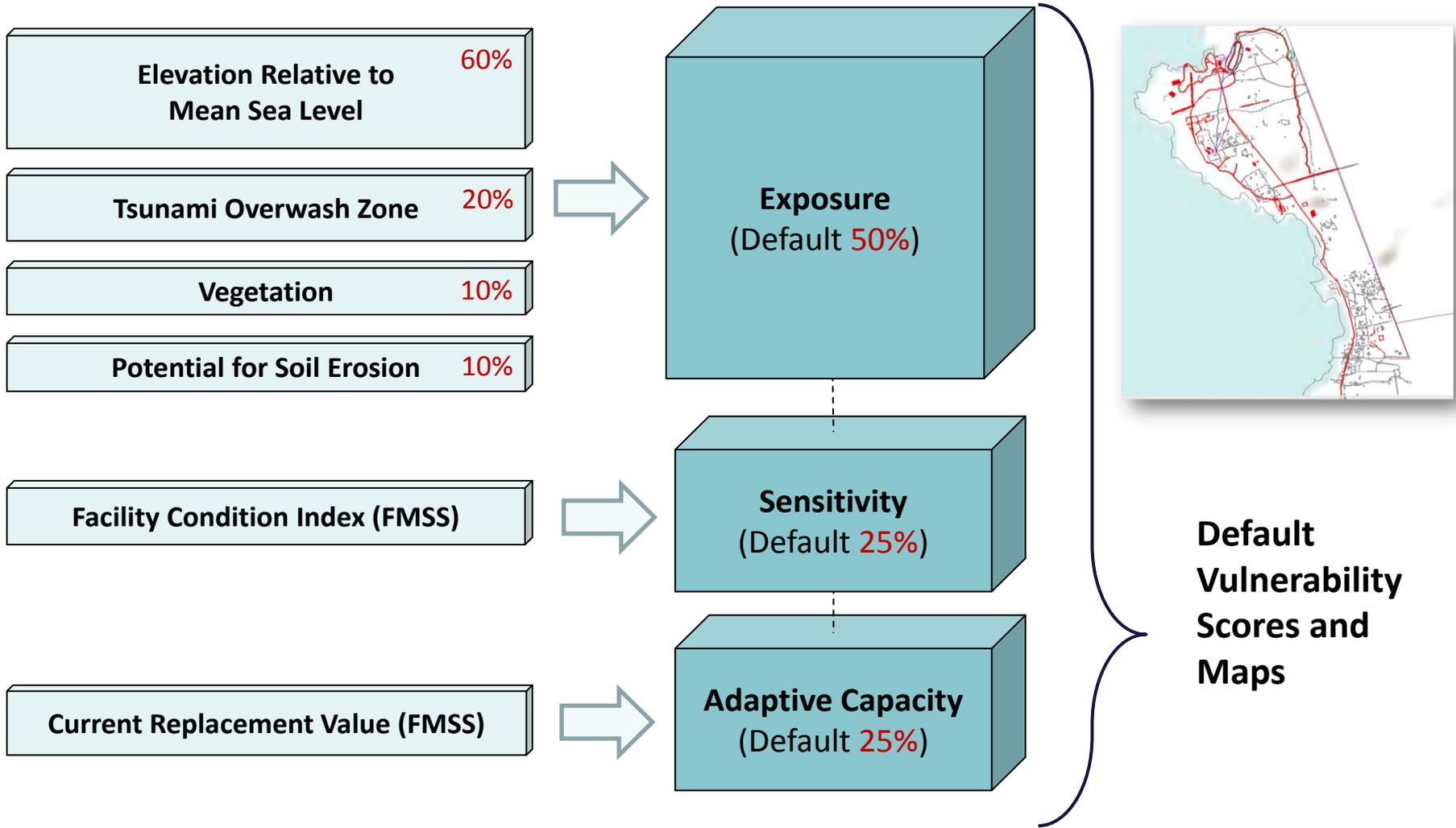


Methodology: Using Indicators

- Calculates vulnerability “scores” based on indicators
- Indicators capture both characteristics of assets (e.g., condition, current replacement value) and location of assets (e.g., location in a 100-year floodzone)
 - In recent years, NPS has developed a strong asset management program (the FMSS database) that provides good data on the characteristics of assets

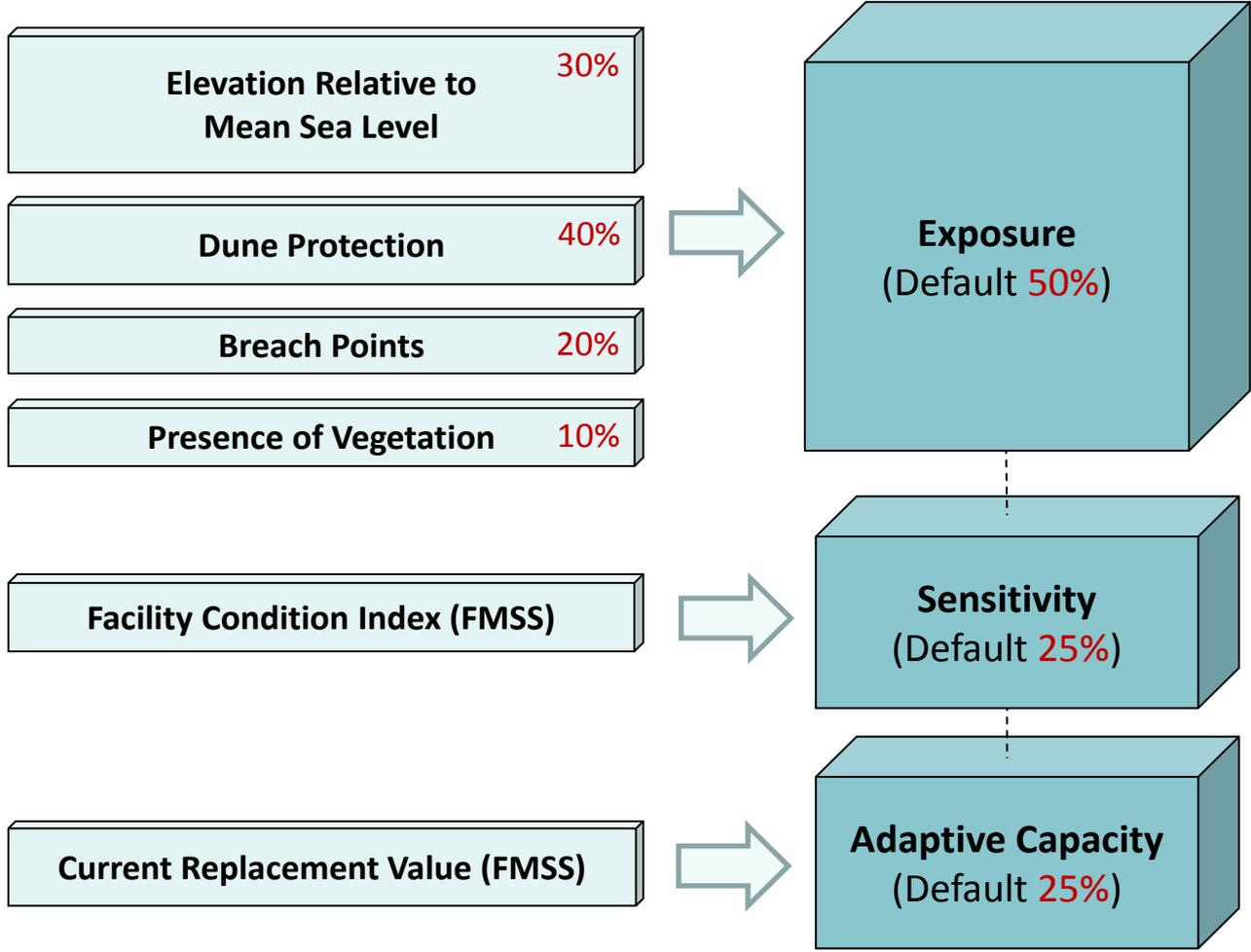


PUHO: Indicators of Vulnerability





ASIS: Indicators of Vulnerability



Default Vulnerability Scores and Maps



Assessing Dune Protection at Assateague

- For much of the Seashore's early history, dune construction and artificial stabilization of the island was promoted in order to protect the island from storms and beach erosion.
- Now only maintained when needed to protect facilities, Park is allowing it to migrate naturally
- Dune is 6 to 9 feet tall and is located very close to the Atlantic shore of the island
- Protects Bayside Campground and North Ocean Beach area as well as stretches of the Virginia district north of Tom's Cove from Atlantic storm surge



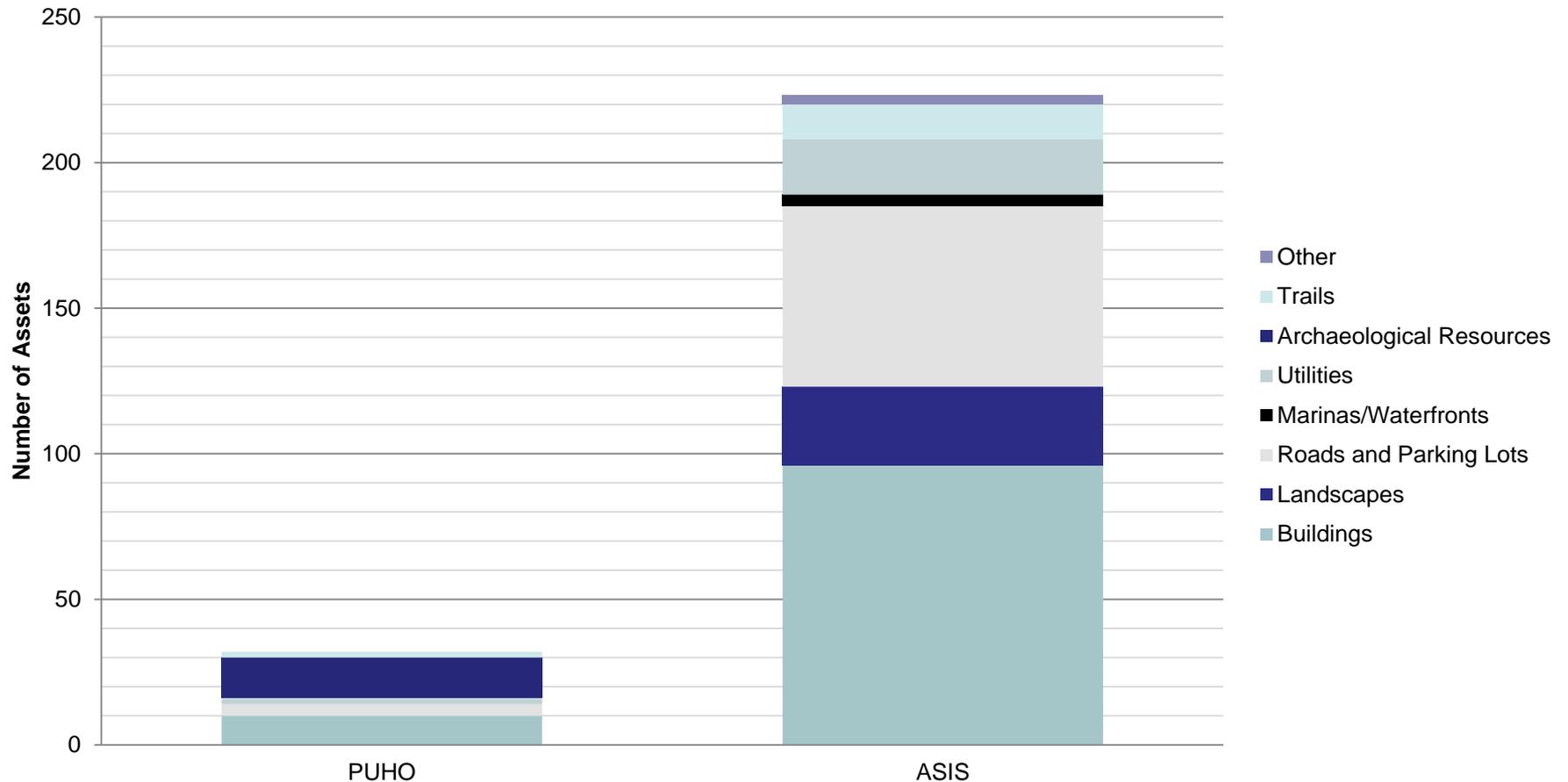
Pilot Workshop Activities

- Confirm list of assets under consideration
- Discuss exposure, sensitivity, and adaptive capacity of assets
 - Review default data
 - Discuss relevant information not captured by default data
 - Adjust scores as needed
- Discuss vulnerability scores for assets
- Brainstorm adaptation options for high priority vulnerable assets



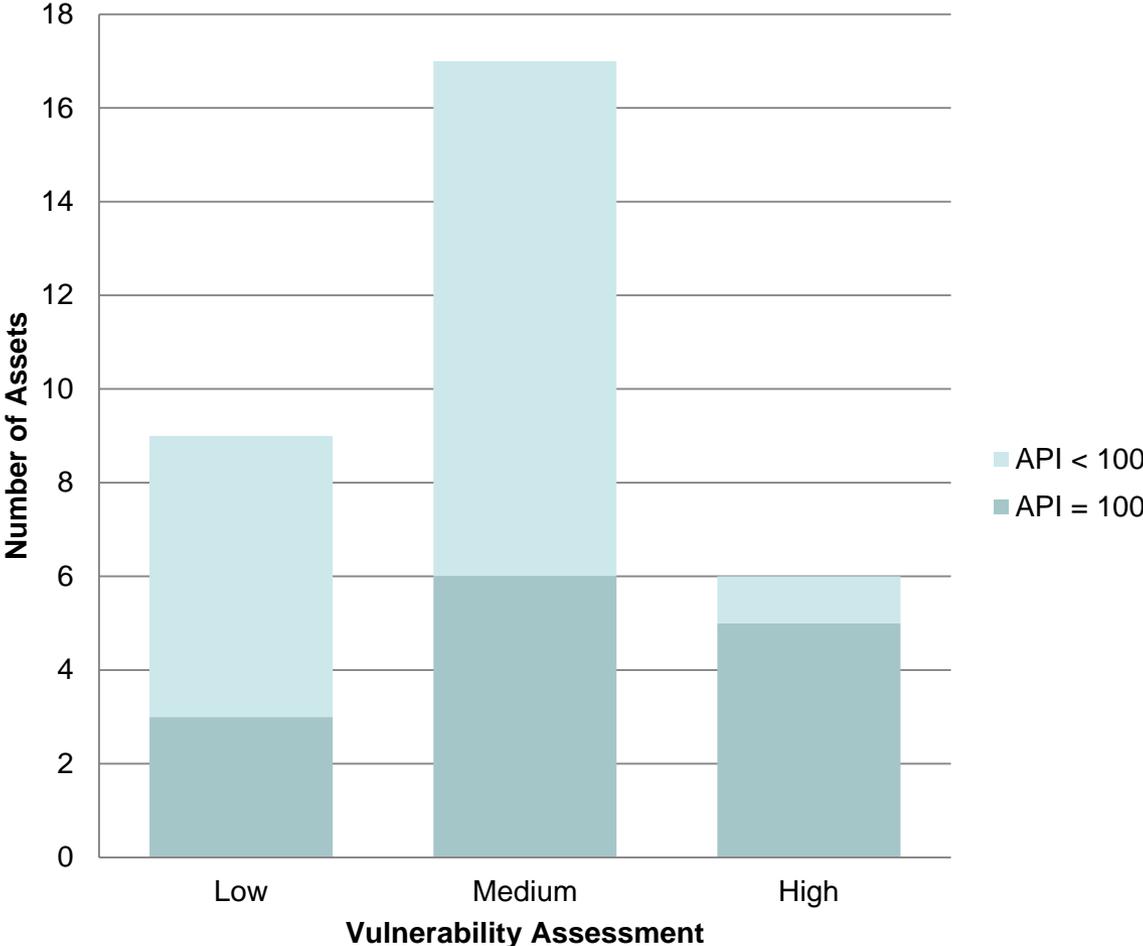
Assets Analyzed at PUHO and ASIS

Number of Assets at Pilot Units, by Asset Type





PUHO Results



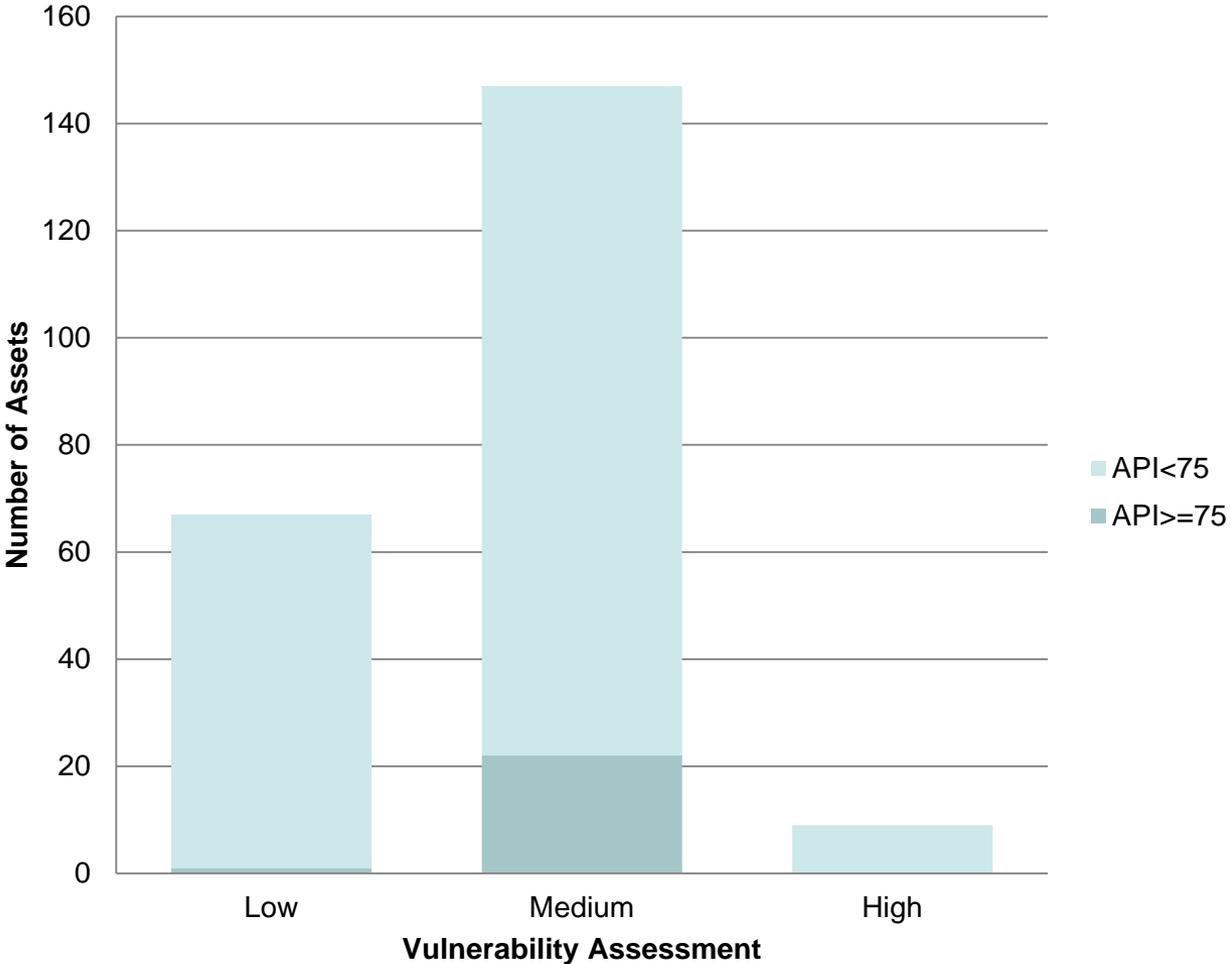
*API = Asset Priority Index

Most Vulnerable Assets:

- (2) Park Heiaus – temples, places of worship or sacrifice
- Honaunau Pu’uhonua Trail
- Great Wall
- 1871 Trail
- Fishing Heiau



ASIS Results



*API = Asset Priority Index

Most Vulnerable Assets:

- U.S. Coast Guard Boathouse, Tower, Station, Generator Building, and Garage
- Pine Tree Campground
- Bunting Bridge
- Bobobells Boardwalk
- Bobobells Grounds
- Bayberry Drive
- Ferry Landing Naturalist Trail
- Life of the Marsh Trail



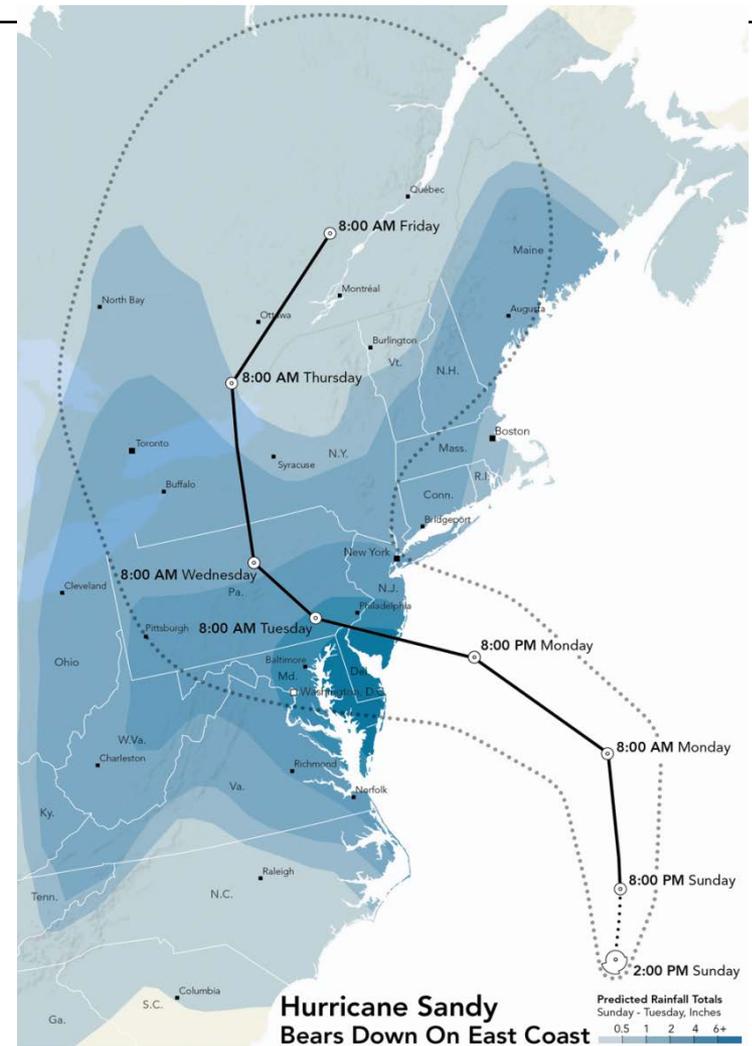
Post-Hurricane Sandy Damage Assessment at Assateague

GROUND-TRUTHING THE VULNERABILITY ASSESSMENT



Post-Hurricane Sandy Assessment

- Hurricane Sandy (October 2012) made landfall just North of Assateague Island
- As a result, the island flooded from the bayside (highly unusual)
- Bayside of island is extremely low-lying, but generally protected by dune





Overall Damage





Key Facilities Damaged in Storm

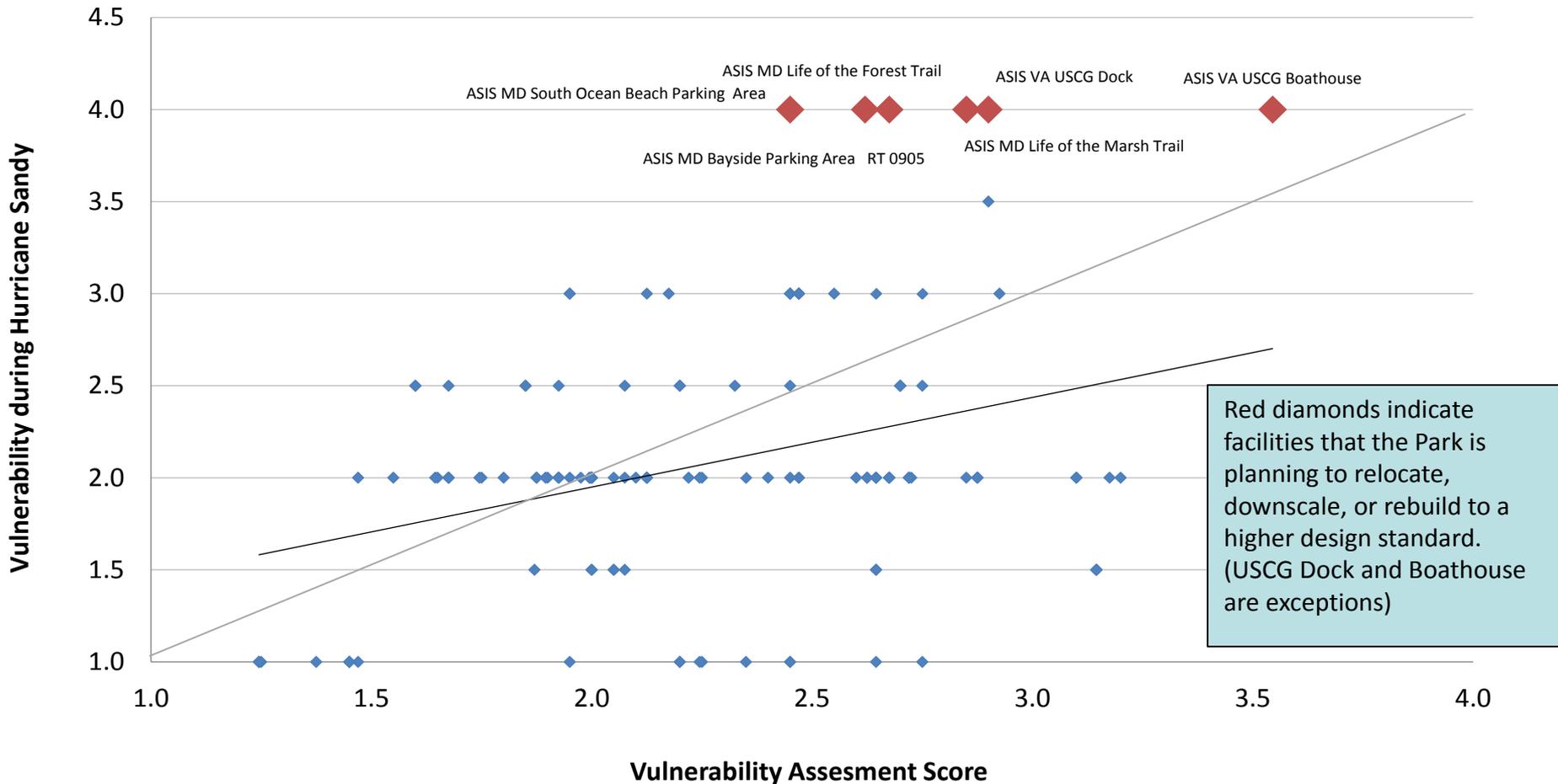
- Coast Guard Dock and Boathouse
- Life of the Marsh boardwalk
- Life of the Forest boardwalk
- Bayside Parking
- South Beach Parking





Predicted Vulnerability vs. Hurricane Sandy Vulnerability

Predicted Vulnerability vs. Hurricane Sandy Vulnerability





How Well Did the Tool Perform?

- Considering Hurricane Sandy's unusual storm path, there is a relatively good correlation between pre- and post-storm vulnerability assessments
- Tool's assumption that the dune would protect South Ocean Beach and Bayside Parking was inaccurate in this case, but in line with Park staff feedback during workshop
- Of the six major facilities where the park is planning adaptation action, the tool accurately screened for 3 in its "top 10" list of vulnerable facilities



Key Take-Homes from Post-Sandy Assessment

- Historic structures are highly expensive to repair (\$500 million for Coast Guard dock), more difficult to justify abandoning
- New structures significantly outperformed old structures due to design improvements (elevating and anchoring)
- Assateague is uniquely vulnerable to storm surge and sea level rise; exposure depends mainly on the storm path



Post-Sandy Adaptive Reconstruction

- After past storm events, Assateague made updates such as orienting parking lots north-south, rather than east-west
- As a result of the damage from Hurricane Sandy, the Park will be abandoning Bayside Parking and South Beach Parking Lots. Alternative parking sites will be expanded.
- Assateague will be abandoning several of the boardwalks crossing the dune, and elevating/anchoring remaining ones
- Assateague will abandon a large portion of the damaged Life of the Forest elevated boardwalk (lower interpretive value), and elevating/anchoring the Life of the Marsh boardwalk (to tell a story about sea level rise)

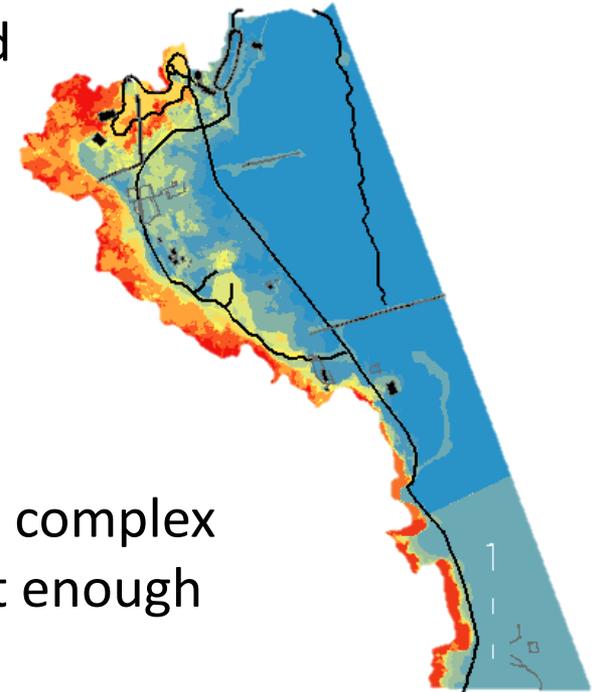


LESSONS LEARNED



Lessons Learned from Pilot Workshops

- Adaptation decision-making should be informed by data, but not exclusively data-driven.
- Using indicators of exposure, sensitivity, and adaptive capacity to evaluate vulnerability is effective because it provides an actionable framework.
- It is important to develop a methodology that is complex enough to capture vulnerability, but transparent enough to enable effective engagement of unit staff.
- Integrating asset data from existing systems (FMSS) with information on climate hazards empowers park staff to incorporate climate change concerns into day-to-day decision making.



PUHO Exposure Score
Layer with Assets



Lessons Learned from Pilot Workshops

- Structured activities that ask participants to isolate and consider each of the components of vulnerability in turn are effective in solidifying participant understanding of these different components.
- Focusing on specific facilities makes the vulnerability assessment and adaptation planning discussions highly relevant and immediately useful to unit staff.
- Considering historical examples and “what-if” scenarios are valuable in thinking creatively about potential adaptation strategies.
- When local experts were invited to speak at the workshops, unit staff really appreciated their perspectives and making or deepening their connections to those local resources.



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Questions?
