Beach and Cliff Habitats

Climate Vulnerability Assessment and Adaptation Strategies for Hawai'i

HABITAT DESCRIPTION

As the biggest island in the Hawaiian archipelago, Hawai'i has the longest shoreline in the state, including extensive bluff and cliff faces and more limited sandy beach habitat. Coastal conditions range from arid to wet, and waves, storms, and precipitation shape beach and cliff vegetative and faunal communities. Beach and cliff habitats support a variety of wildlife, including terrestrial and aquatic invertebrates, migratory shorebirds, seabirds, and nesting or basking marine species, as well as cultural uses (e.g., settlements, trails, cave exits, burial sites).

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HABITAT VULNERABILITY

Beach and cliff habitats are sensitive to climatic factors and disturbance regimes that accelerate erosion rates, alter sediment delivery dynamics, or increase inundation risk, as these factors reduce habitat availability and alter community composition. Non-climate stressors reduce existing coastal habitat area and elevate disturbance, which can endanger or eliminate component native vegetative and faunal communities. Native fauna and vegetation are also vulnerable to increased mortality, predation, and competition from invasive species and marine debris. Beach and cliff habitats have a high extent, high public value, and some habitats occur in protected areas. However, many existing habitats have been modified by human activity and invasive species, and beach and cliff habitats face use conflicts with coastal development.

Drivers of Habitat Vulnerability

- **Climatic factors and disturbance regimes:** Tropical storms/hurricanes, wave innundation, sea level rise, streamflow, riverine flooding
- **Non-climate factors:** Residential & commercial development, marine debris, agriculture, energy production, invasive species (mammalian predators, trees & shrubs)

PROJECTED FUTURE CHANGES	POTENTIAL IMPACTS ON BEACH AND CLIFF HABITATS
Increased frequency & strength of **tropical storms/ hurricanes**; no change or small decrease in **wave heights**	• Increased beach inundation and erosion, altering beach width and grade • Accelerated cliff retreat, and increased risk of landslides • Wind and waves damage and kill native vegetation and/or alter coastal vegetative community composition by changing soil salinity and moisture
Sea level rise *+0.4 m (1.3 ft) to +3.3 m (10.8 ft) by 2100*	• Increased beach inundation and erosion (cliffs less vulnerable to inundation); some beach habitats may be lost if inland retreat is not possible • Reduced area for monk seal haul-out, turtle nesting and basking, and seabird nesting • Reduced intertidal foraging opportunities for birds
Reduced **baseflows**; increasingly variable **riverine flooding**	• May alter persistence of some vegetative communities by affecting streamflow sediment and nutrient delivery • May alter shoreline position by affecting sediment delivery and erosion • Flooding can increase coastal inundation

ADAPTIVE CAPACITY

Factors that enhance adaptive capacity:

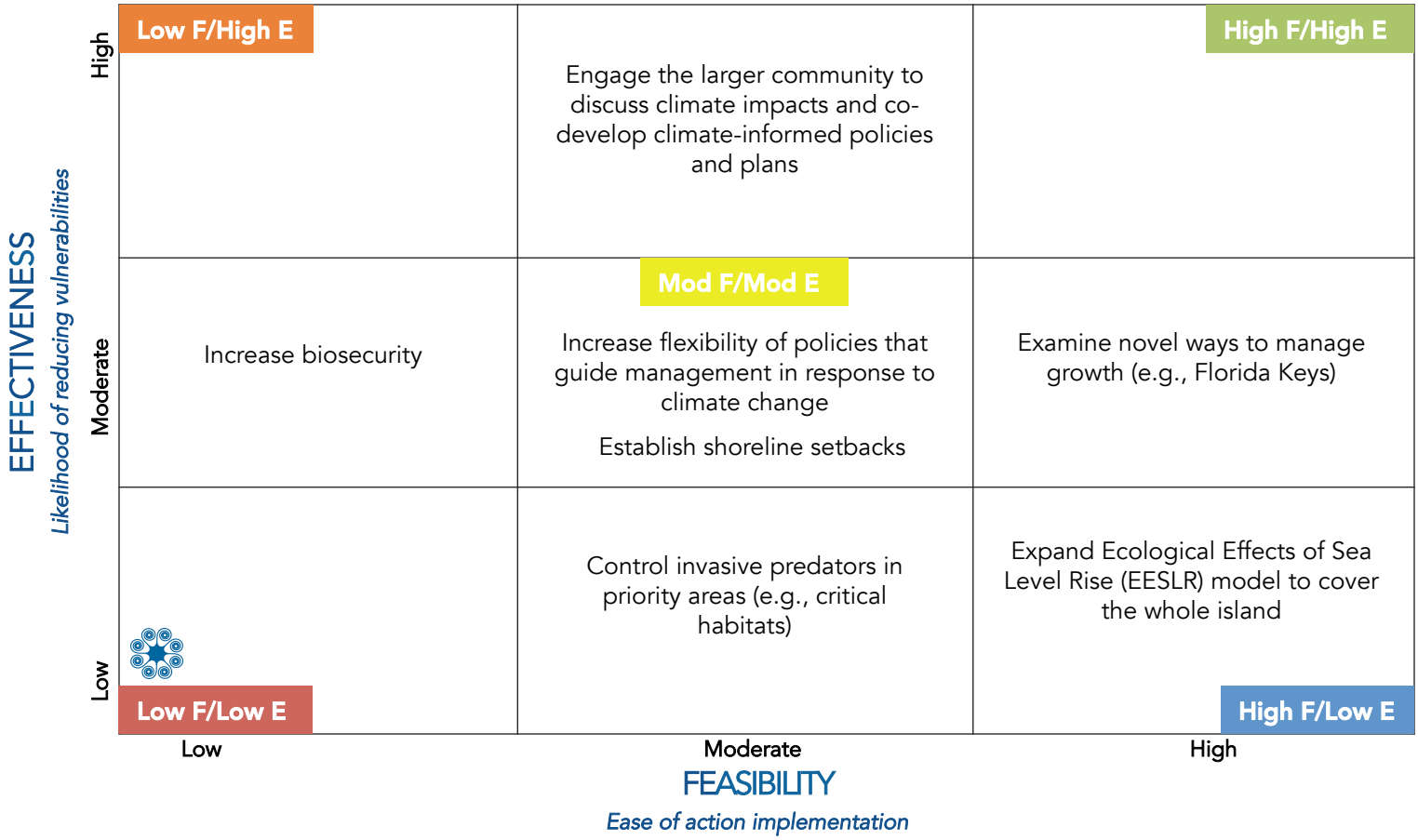
+ High habitat extent
+ Shoreline fauna adapted to dynamic conditions
+ Some habitat areas are protected and managed
+ High public value, and several constituency groups increase support for habitat conservation and management
+ Provide many ecosystem services

Factors that undermine adaptive capacity:

– Many habitats degraded by human activity and invasive species
– Small tidal ranges limit beach capacity to accrete sediment and keep pace with sea level rise, and armoring limits landward retreat
– Have several species that are very sensitive to change or habitat loss
– Face competing interests with coastal development

ADAPTATION STRATEGIES FOR BEACH AND CLIFF HABITATS

Types of Adaptation Approaches	Adaptation Strategy	Specific Action
Resistance: Prevent climate change from affecting a resource. *Near-term approach*	Manage invasive species	• Increase biosecurity • Control invasive predators in priority areas (e.g., critical habitats)
Resilience: Help resources weather climate change by avoiding the effects of or recovering from changes *Near- to mid-term approach*	Create more nimble planning and zoning processes that promote natural landscapes and community values and are adaptable to climate change	• Examine novel ways to manage growth (e.g., Florida Keys) • Increase flexibility of policies that guide management in response to climate change (e.g., shorten land use/general planning timeframe)
Response: Intentionally accommodate change and adaptively respond to variable conditions *Long-term approach*	Protect current and future habitat	• Establish shoreline setbacks
Knowledge: Gather information about climate impacts and/or management effectiveness in addressing climate challenges *Near- to long-term approach*	Change laws/policies to protect and promote community response to climatic changes and impacts	• Expand Ecological Effects of Sea Level Rise (EESLR) model to cover the whole island
Collaboration: Coordinate efforts and capacity across landscapes and agencies *Near- to long-term approach*	Change laws/policies to protect and promote community response to climatic changes and impacts	• Engage the larger community to discuss climate impacts and co-develop climate-informed policies and plans



Further information and citations can be found in the Hawaiian Islands Climate Vulnerability and Adaptation Synthesis and other products available online at www.bit.ly/HawaiiClimate.

Reynier WA, Gregg RM. 2018. Beach and Cliff Habitats: Vulnerability and Adaptation Brief for Hawai'i. EcoAdapt, Bainbridge Island, WA. Produced in cooperation with the Pacific Islands Climate Change Cooperative, with funding from the U.S. Fish and Wildlife Service.