

Beach and Shoreline Habitats

Climate Vulnerability Assessment and Adaptation Strategies for Maui, Lānaʻi, and Kahoʻolawe

HABITAT DESCRIPTION

Beach and shoreline habitats occur in low-lying coastal areas on Maui Nui and include sandy beaches, boulder/rocky beaches, rocky cliffs and coastal shelves (limestone or lava), dunes, coastal shrubs and strands, and manmade coastal structures. These habitats support wet, mesic, and dry vegetative communities, as well as a variety of wildlife species, including terrestrial and aquatic invertebrates, migratory birds, and nesting or basking marine species. Beaches, cliffs, and coastal shelves are exposed to waves and tides, while dunes and coastal strand communities experience less frequent exposure.



HABITAT VULNERABILITY

Sea level rise, storms, and extreme precipitation events accelerate coastal erosion and increase beach and shoreline susceptibility to inundation. Along with drought, wildfire, and flooding, these factors influence vegetative composition, with potential implications for the persistence of native species. Non-climate stressors (e.g., development, agricultural conversion, roads, recreation, and invasive species) compound climate-driven habitat reductions and vegetative shifts, and also degrade remnant habitat quality by promoting runoff and erosion and facilitating invasive vegetation establishment. Beach and shoreline habitats are highly valued, highly managed, and are protected in some areas. However, many habitats have been degraded, and human land uses prevent inland migration in response to sea level rise.



Drivers of Habitat Vulnerability

- **Climatic factors and disturbance regimes:** Sea level rise, coastal flooding, shoreline change, tropical storms/hurricanes, drought, extreme precipitation events, riverine flooding, wildfire
- **Non-climate factors:** Residential & commercial development, pollution & poisons, invasive species (vegetation, ungulates), roads/highways/trails, recreation, agriculture

PROJECTED FUTURE CHANGES	POTENTIAL IMPACTS ON BEACH AND SHORELINE HABITATS
<p>Sea level rise; increased coastal flooding & shoreline change +0.4 m (1.3 ft) to +3.3 m (10.8 ft) of sea level rise by 2100</p>	<ul style="list-style-type: none"> • Increased habitat loss due to inundation, coastal erosion, and cliff collapse • Reduced Hawaiian monk sea haul out areas, sea turtle nesting and basking habitat, and seabird nesting habitat • Reduced intertidal foraging areas for birds • Increased erosion and coastal strand overtopping due to greater reach of high tides and large waves
<p>Increased frequency and strength of tropical storms/hurricanes; uncertain changes in extreme precipitation events; increasingly variable riverine flooding</p>	<ul style="list-style-type: none"> • Damage to coastal vegetation from wind and waves • Changes in soil salinity and moisture, potentially altering coastal plant community composition • Increased beach inundation and shoreline erosion (including bluff failure) due to runoff, flash flooding, wind, and wave exposure
<p>Increased drought risk</p>	<ul style="list-style-type: none"> • Increased risk of wildfire • May favor invasive vegetation, displacing native species
<p>Increased wildfire</p>	<ul style="list-style-type: none"> • Increased vegetation mortality and establishment of invasive species • Increased runoff and erosion due to vegetation removal

ADAPTIVE CAPACITY

Factors that enhance adaptive capacity:

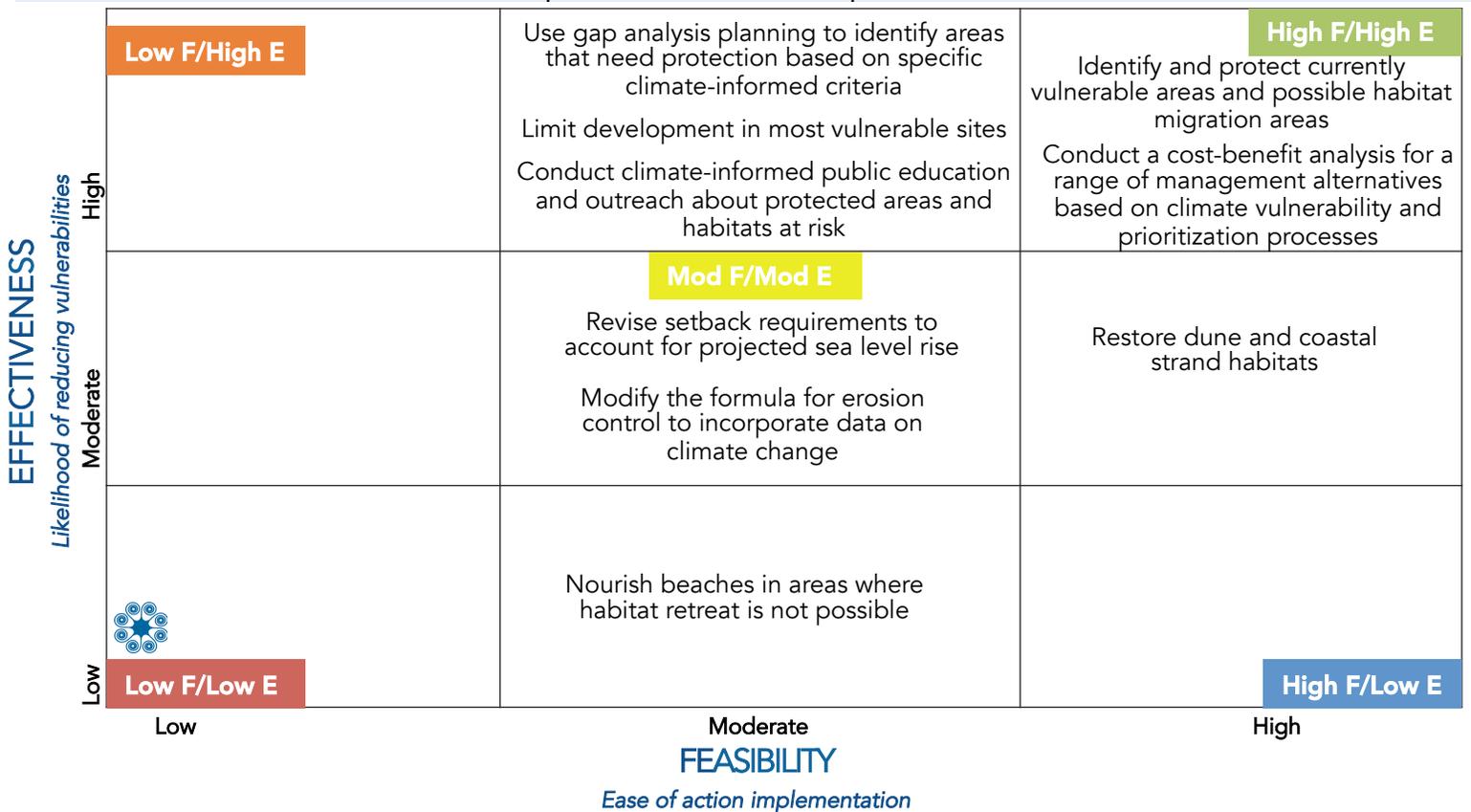
- + High habitat extent; some areas have high habitat integrity due to their remoteness (e.g., East Maui)
- + High public value and provide many ecosystem services (e.g., tourism/recreation, storm protection, food provisioning)
- + Some areas have protected status and are highly managed, which may bolster resilience

Factors that undermine adaptive capacity:

- Low habitat integrity in many areas
- Highly isolated dune habitats
- Small tidal ranges limit capacity to accrete sediment and keep pace with sea level rise
- Loss of seed sources due to habitat fragmentation and human activities prevents vegetation recovery
- Low societal support for managing/conserving habitat

ADAPTATION STRATEGIES FOR BEACH AND SHORELINE HABITATS

Types of Adaptation Approaches	Adaptation Strategy	Specific Action
Resistance: Prevent climate change from affecting a resource. <i>Near-term approach</i>	Restore and conserve native shoreline habitat	<ul style="list-style-type: none"> Nourish beaches in areas where habitat retreat is not possible
Resilience: Help resources weather climate change by avoiding the effects of or recovering from changes <i>Near- to mid-term approach</i>	Protect current and future habitat	<ul style="list-style-type: none"> Use gap analysis planning to identify areas that need protection based on specific climate-informed criteria
	Implement climate-informed coastal zoning protections	<ul style="list-style-type: none"> Modify the formula for erosion control to incorporate data on climate change Revise setback requirements based on projected sea level rise
Response: Intentionally accommodate change and adaptively respond to variable conditions <i>Long-term approach</i>	Implement climate-informed coastal zoning protections	<ul style="list-style-type: none"> Limit development in most vulnerable sites
Knowledge: Gather information about climate impacts and/or management effectiveness in addressing climate challenges <i>Near- to long-term approach</i>	Anticipate and facilitate habitat migration	<ul style="list-style-type: none"> Conduct a cost-benefit analysis for a range of management alternatives based on climate vulnerability and prioritization processes Identify and protect currently vulnerable areas and areas of possible habitat migration based on available data, including existing infrastructure lifetime
Collaboration: Coordinate efforts and capacity across landscapes and agencies <i>Near- to long-term approach</i>	Build support for coastal habitat protection	<ul style="list-style-type: none"> Conduct climate-informed public education and outreach about protected areas and habitats at risk



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.

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