

Sandy & Rocky Shoreline Habitats

Climate Vulnerability Assessment and Adaptation Strategies for O'ahu

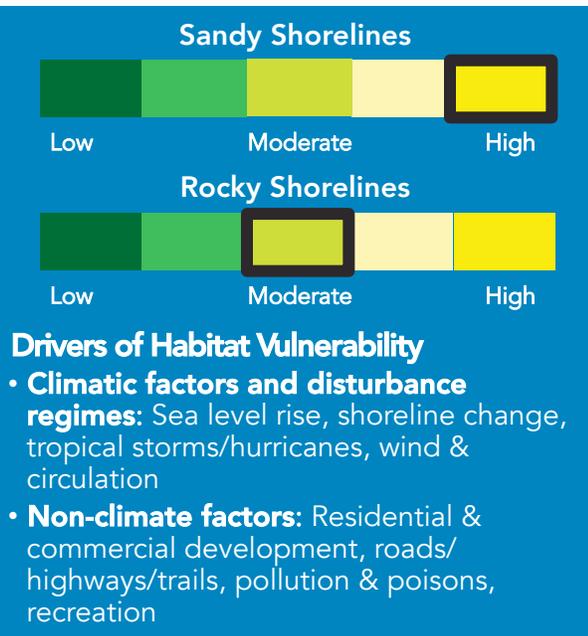
HABITAT DESCRIPTION

Sandy shoreline habitats include dunes, continuous beach stretches spanning multiple kilometers, and pocket beaches between rocky headlands. Sandy shorelines received sediment from nearshore sources as well as from the erosion of sand dunes. Rocky shoreline habitats include low-lying rocky shorelines, bluffs, rocky headlands, boulder beaches, and tide pools. Shoreline habitats have steep environmental gradients due to exposure to both terrestrial (e.g., air temperature) and marine drivers (e.g., waves, tides). Shorelines buffer inland habitats and human communities from flooding and erosion. These habitats support a variety of wildlife, including invertebrates, migratory shorebirds, seabirds, and nesting or basking marine species.



HABITAT VULNERABILITY

Sea level rise, storm-related swell, and trade winds are likely to increase shoreline inundation and erosion, reducing available habitat and altering community structure. Non-climate stressors such as residential and commercial development, shoreline armoring, roads, and highways exacerbate erosion issues by preventing landward habitat migration and restricting sediment supply. Shorelines are also sensitive to other non-climate stressors such as under-managed recreation and pollution and poisons, which degrade habitat suitability for vegetation and wildlife. Degraded habitat condition makes it difficult for shorelines to resist and recover from climate impacts. However, these systems are highly valued by the public and provide many ecosystem services.



PROJECTED FUTURE CHANGES	POTENTIAL IMPACTS ON SANDY AND ROCKY SHORELINE HABITATS
Sea level rise & shoreline change <i>+0.4 m (1.3 ft) to +3.3 m (10.8 ft) of sea level rise by 2100; doubling of beach erosion rates by mid-century</i>	<ul style="list-style-type: none"> Increased habitat loss due to inundation, coastal erosion, and cliff collapse, particularly if landward migration is not possible Reduced Hawaiian monk sea haul-out areas, sea turtle nesting and basking habitat, and seabird nesting habitat Reduced intertidal foraging areas for birds Shifts in rocky shoreline community structure due to heightened wave exposure
Increased frequency and strength of tropical storms/hurricanes	<ul style="list-style-type: none"> Increased beach inundation and shoreline erosion (including bluff failure) due to runoff, flash flooding, wind, and wave exposure Damage to coastal vegetation from wind and waves Changes in soil salinity and moisture, potentially altering plant community composition Changes in rocky shoreline community structure due to increased wave action
Changes in wind & circulation	<ul style="list-style-type: none"> Potential increase in sandy shoreline erosion with more wind waves Winds facilitate inland plant dispersal and prevent seaward plant colonization

ADAPTIVE CAPACITY

Factors that enhance adaptive capacity:

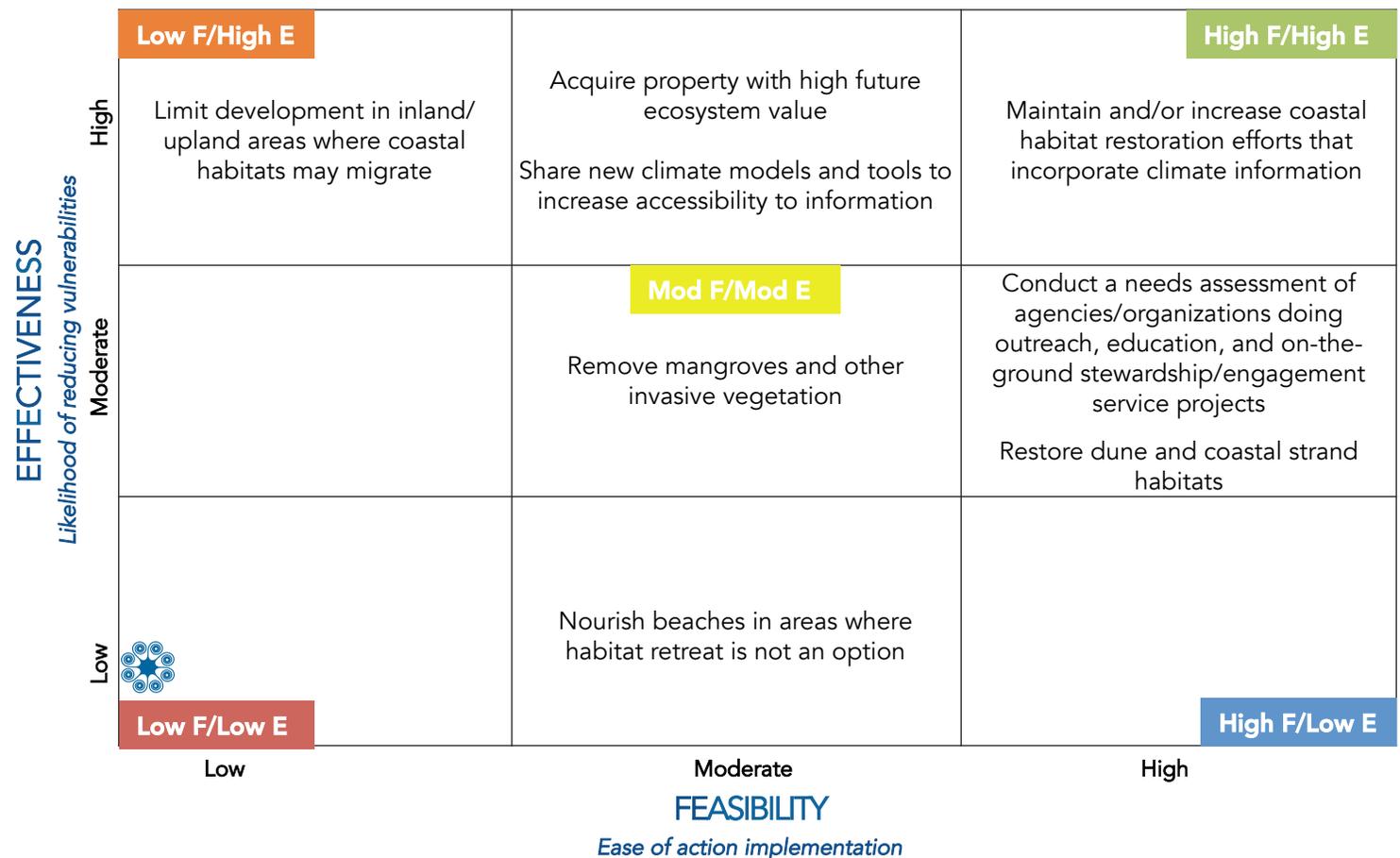
- + Abundant and extensive shoreline habitat area
- + Shoreline fauna typically adapted to dynamic and extreme conditions
- + Rocky shorelines somewhat resistant to erosion, and recover rapidly from disturbance
- + Valued by public and provide many ecosystem services

Factors that undermine adaptive capacity:

- Degraded habitat integrity due to human land use and activities
- Small tidal ranges limit sandy beach capacity to accrete sediment and keep pace with sea level rise
- Armoring prevents landward migration
- Shorelines face use conflicts with development interests

ADAPTATION STRATEGIES FOR SANDY & ROCKY 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 and estuary habitat	<ul style="list-style-type: none"> Remove mangroves and other invasive vegetation Nourish beaches in areas where habitat retreat is not an option
Resilience: Help resources weather climate change by avoiding the effects of or recovering from changes <i>Near- to mid-term approach</i>	Restore and conserve native shoreline and estuary habitat	<ul style="list-style-type: none"> Restore dune and coastal strand habitats Maintain and/or increase coastal habitat restoration efforts that incorporate climate information
Response: Intentionally accommodate change and adaptively respond to variable conditions <i>Long-term approach</i>	Anticipate and facilitate habitat migration	<ul style="list-style-type: none"> Acquire property with high future ecosystem value (i.e. less developed, less exposed/vulnerable sites) Limit development in inland/upland areas where coastal habitats may migrate
Knowledge: Gather information about climate impacts and/or management effectiveness in addressing climate challenges <i>Near- to long-term approach</i>	Coordinate and amplify public education and outreach messages	<ul style="list-style-type: none"> Conduct a needs assessment of agencies/organizations doing outreach, education, and on-the-ground stewardship/engagement service projects
Collaboration: Coordinate efforts and capacity across landscapes and agencies <i>Near- to long-term approach</i>	Improve science-management communication and partnerships	<ul style="list-style-type: none"> Share new climate models and tools to increase accessibility to information



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.