

# Estuarine & Coastal Wetland Habitats

Climate Vulnerability Assessment and Adaptation Strategies for Kaua'i

## HABITAT DESCRIPTION

Estuarine and coastal wetland habitats (including tidal marshes and salt marshes) occur at the fresh and saltwater interface, and are characterized by brackish water conditions. Salinity, water temperature, water levels, and dissolved oxygen levels vary temporally and spatially according to freshwater input and tidal influence. Estuaries feature extensive deep-water habitat and have direct ocean connectivity because they occur at the river-ocean interface. Tidal marshes and salt marshes have intermittent tidal connectivity, and typically feature herbaceous and emergent salt-tolerant vegetation fringing seasonal or permanent standing water. Estuaries and coastal wetlands support a variety of wildlife, including estuarine and marine species, endemic waterbirds, and migratory waterfowl and shorebirds.



## HABITAT VULNERABILITY

A variety of climatic changes and disturbance regimes affect coastal wetland and estuary extent, distribution, hydrology, salinity, and water quality, which can impact habitat suitability and use by native wildlife, and increase habitat vulnerability to exotic species establishment and dominance. Invasive species displace or eliminate native species by elevating competition and predation and/or increasing disturbance, sedimentation, and exotic diseases. Other non-climate stressors (e.g., agriculture) can further limit habitat distribution, alter hydrology, and increase contaminant loads. High habitat extent, high public value, and the protected status of some areas bolsters habitat adaptive capacity, while degraded habitat condition and competition for water with human uses undermines adaptive capacity.



### Drivers of Habitat Vulnerability

- **Climatic factors and disturbance regimes:** Sea level rise, coastal flooding, saltwater intrusion, streamflow, soil moisture, precipitation amount & timing, drought, riverine flooding, disease
- **Non-climate factors:** Invasive species (trees, shrubs, grasses, aquatic weeds) rats, cats, pigs, fish, amphibians), agriculture & aquaculture, water diversions, pollution & poisons, roads/highways/trails, dikes

PROJECTED FUTURE CHANGES	POTENTIAL IMPACTS ON ESTUARINE & COASTAL WETLAND HABITATS
Sea level rise; increased coastal flooding & saltwater intrusion <i>+0.4 m (1.3 ft) to +3.3 m (10.8 ft) of sea level rise by 2100</i>	<ul style="list-style-type: none"> <li>• Increased salinity: may cause shifts to more salt-tolerant vegetation, reduce seed germination (which reduces species richness and cover), and increase exotic dominance</li> <li>• Increased flooding depth and duration: alleviates extreme conditions but potentially facilitates exotic species introductions</li> <li>• Shifts in habitat abundance and distribution; potential habitat loss if inland migration is not possible</li> </ul>
Reduced baseflows; increasingly variable riverine flooding	<ul style="list-style-type: none"> <li>• Altered estuarine extent and salinity</li> <li>• Low flows reduce coastal wetland extent and promote extreme conditions</li> <li>• High flows moderate extreme temperature and salinity conditions, but degrade water quality by delivering sediment, nutrients, and contaminants</li> <li>• Altered food webs by altering particulate organic matter input</li> </ul>
Changes in precipitation; variable drought risk (increased in low elevation leeward areas, static elsewhere); reduced soil moisture	<ul style="list-style-type: none"> <li>• Drier conditions alter hydroperiods and reduce habitat extent</li> <li>• Drier conditions stunt plant growth and reduce plant survival</li> <li>• Drier conditions promote exotic dominance and increase fire risk</li> </ul>

## ADAPTIVE CAPACITY

### Factors that enhance adaptive capacity:

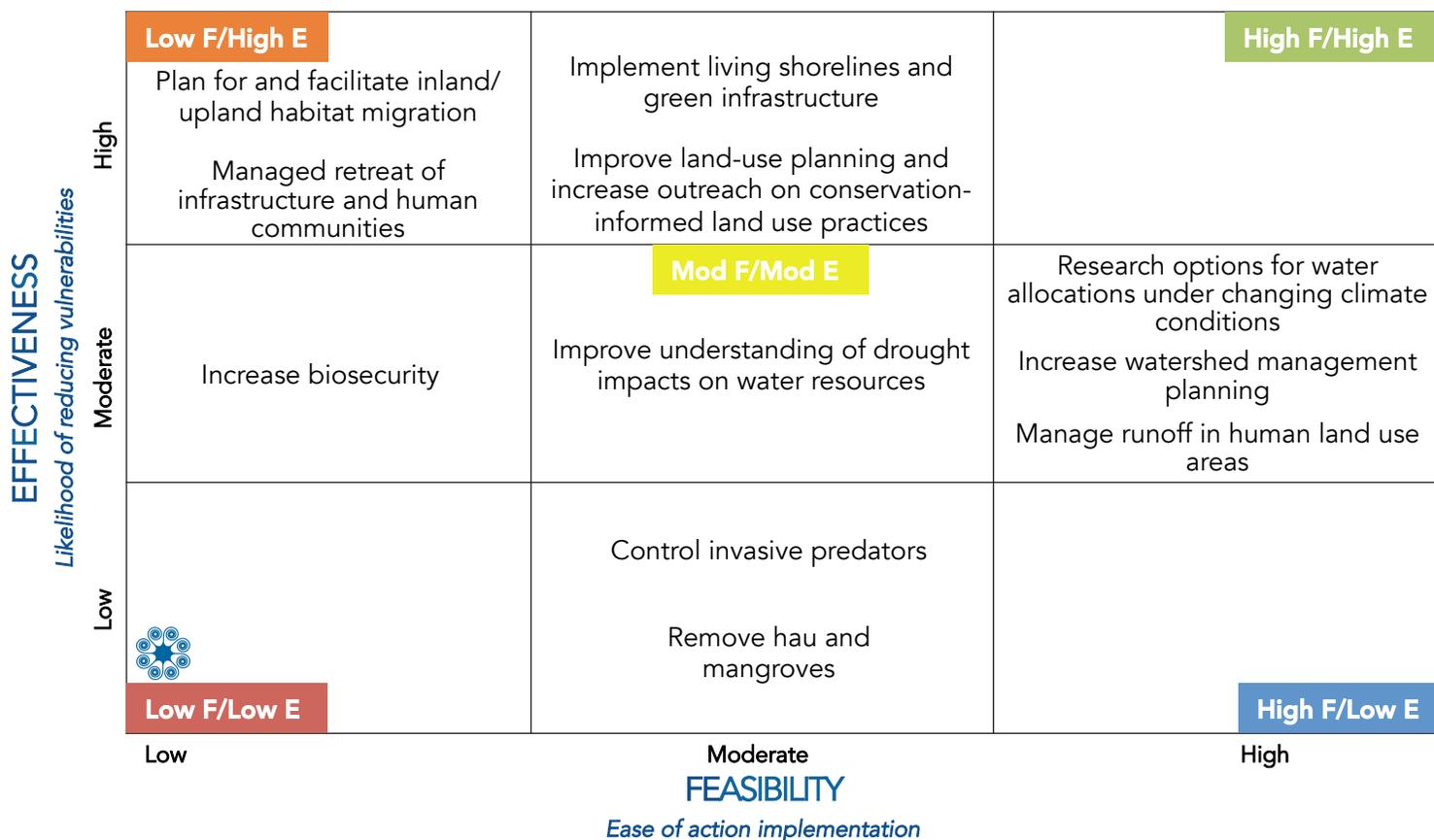
- + High habitat extent
- + Several habitat areas have protected status, which may help buffer impacts
- + Managed wetlands are better able to resist and recover from stressors, and have higher diversity
- + Estuarine species adapted to variable conditions
- + High public value and provide many ecosystem services

### Factors that undermine adaptive capacity:

- Many habitats degraded by invasive species and hydrology changes
- Unmanaged wetlands have low resilience to stressors
- Limited capacity to accrete sediment due to small tidal ranges
- Several species very sensitive to climate changes (e.g., rearing freshwater fish)
- Compete for water with human uses

# ADAPTATION STRATEGIES FOR ESTUARINE & COASTAL WETLAND HABITATS

Types of Adaptation Approaches	Adaptation Strategy	Specific Action
<b>Resistance:</b> Prevent climate change from affecting a resource. <i>Near-term approach</i>	Manage invasive species	<ul style="list-style-type: none"> <li>• Increase biosecurity</li> <li>• Control invasive predators via trapping in priority areas (i.e. critical habitats)</li> <li>• Remove hau and mangroves</li> </ul>
<b>Resilience:</b> Help resources weather climate change by avoiding the effects of or recovering from changes <i>Near- to mid-term approach</i>	Maintain/improve water quantity and quality	<ul style="list-style-type: none"> <li>• Increase watershed management planning</li> </ul>
<b>Response:</b> 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"> <li>• Implement living shorelines and green infrastructure</li> <li>• Plan for and facilitate inland/upland habitat migration</li> <li>• Facilitate managed retreat of infrastructure and human communities</li> </ul>
<b>Knowledge:</b> Gather information about climate impacts and/or management effectiveness in addressing climate challenges <i>Near- to long-term approach</i>	Increase understanding of water quality, quantity, and allocations under changing climate conditions	<ul style="list-style-type: none"> <li>• Improve understanding of drought impacts on water resources</li> <li>• Research options for water allocations under changing climate conditions</li> </ul>
<b>Collaboration:</b> Coordinate efforts and capacity across landscapes and agencies <i>Near- to long-term approach</i>	Reduce human pressure on native ecosystems and species	<ul style="list-style-type: none"> <li>• Improve land-use planning and increase outreach on conservation-informed land uses</li> </ul>



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](http://www.bit.ly/HawaiiClimate).

Reynier WA, Gregg RM. 2018. Estuarine and Coastal Wetland Habitats: Vulnerability and Adaptation Brief for Kaua'i. EcoAdapt, Bainbridge Island, WA.

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