

Lowland Wetland Habitats

Climate Vulnerability Assessment and Adaptation Strategies for Kaua'i

HABITAT DESCRIPTION

Lowland wetlands feature permanent or intermittent ponded fresh water derived from precipitation, river and stream runoff, and groundwater inflow. Water level fluctuates throughout the year, with highest water levels typically occurring during the winter wet season. Standing water is typically surrounded by emergent vegetation, including native sedges, 'akulikuli, native water hyssop, beach dropseed grass, and non-native California bulrush. Irrigated agricultural fields (e.g., taro) also provide lowland wetland habitat. Lowland wetlands support many endangered plants and provide important habitat for endemic waterbirds, migratory shorebirds and waterfowl, fish, and invertebrates. They also have historic and contemporary cultural importance (e.g., taro, sedges for home construction).



HABITAT VULNERABILITY

A variety of climatic factors and disturbance regimes affect lowland wetland hydrology, influencing habitat availability, vegetation communities, and wildlife utilization. Sea level rise, saltwater intrusion, and storm surge increase wetland salinity. Air and water temperature and soil moisture impact plant germination and vegetative composition. Non-climate stressors (e.g., agriculture, water diversions) may reduce overall habitat extent and exacerbate hydrological changes. Other stressors (e.g., pollution, invasive species) degrade habitat quality and suitability for wildlife. A variety of barriers prevent inland habitat migration, and vegetation is not very resilient to invasive species or human-driven hydrology changes. However, some wetlands are protected and managed.



Drivers of Habitat Vulnerability

- **Climatic factors and disturbance regimes:** Precipitation amount & timing, streamflow, drought, sea level rise, flooding, saltwater intrusion, air temperature, tropical storms/hurricanes, soil moisture, stream temperature, insects, disease
- **Non-climate factors:** Agriculture & aquaculture, invasive species (fish, vegetation, ungulates), water diversions, residential & commercial development, pollution & poisons

PROJECTED FUTURE CHANGES	POTENTIAL IMPACTS ON LOWLAND WETLAND HABITATS
Changes in precipitation; increased drought risk in low elevation leeward areas; reduced soil moisture	<ul style="list-style-type: none"> • Altered hydroperiods, impacting vegetation composition and cover • Higher rainfall promotes ponding of seasonal or temporary wetlands • Drier conditions reduce native plant survival and may favor invasive species
Reduced baseflows; increasingly variable riverine flooding	<ul style="list-style-type: none"> • Flooding required for plant germination • High flows flush wetlands, but also deliver sediment and contaminants
Sea level rise; increased coastal flooding & saltwater intrusion +0.4 m (1.3 ft) to +3.3 m (10.8 ft) of sea level rise by 2100	<ul style="list-style-type: none"> • Increased salinity may cause shifts to more salt-tolerant vegetation and reduce seed germination (reducing species richness/cover) • Increased flooding depth and duration • Potential habitat loss via transition to brackish marsh or inundation
Increased air temperatures +2.0°C (3.6°F) to +3.5°C (6.3°F) by 2100	<ul style="list-style-type: none"> • Reduced plant germination, particularly if in concert with more saline conditions • Increased avian botulism & egg mortality
Increased frequency and strength of tropical storms/hurricanes	<ul style="list-style-type: none"> • Increased spread of invasive species • Storm surge exacerbates sea level rise impacts
Increased insects & disease	<ul style="list-style-type: none"> • Increased bird mortality and reduced nesting success

ADAPTIVE CAPACITY

Factors that enhance adaptive capacity:

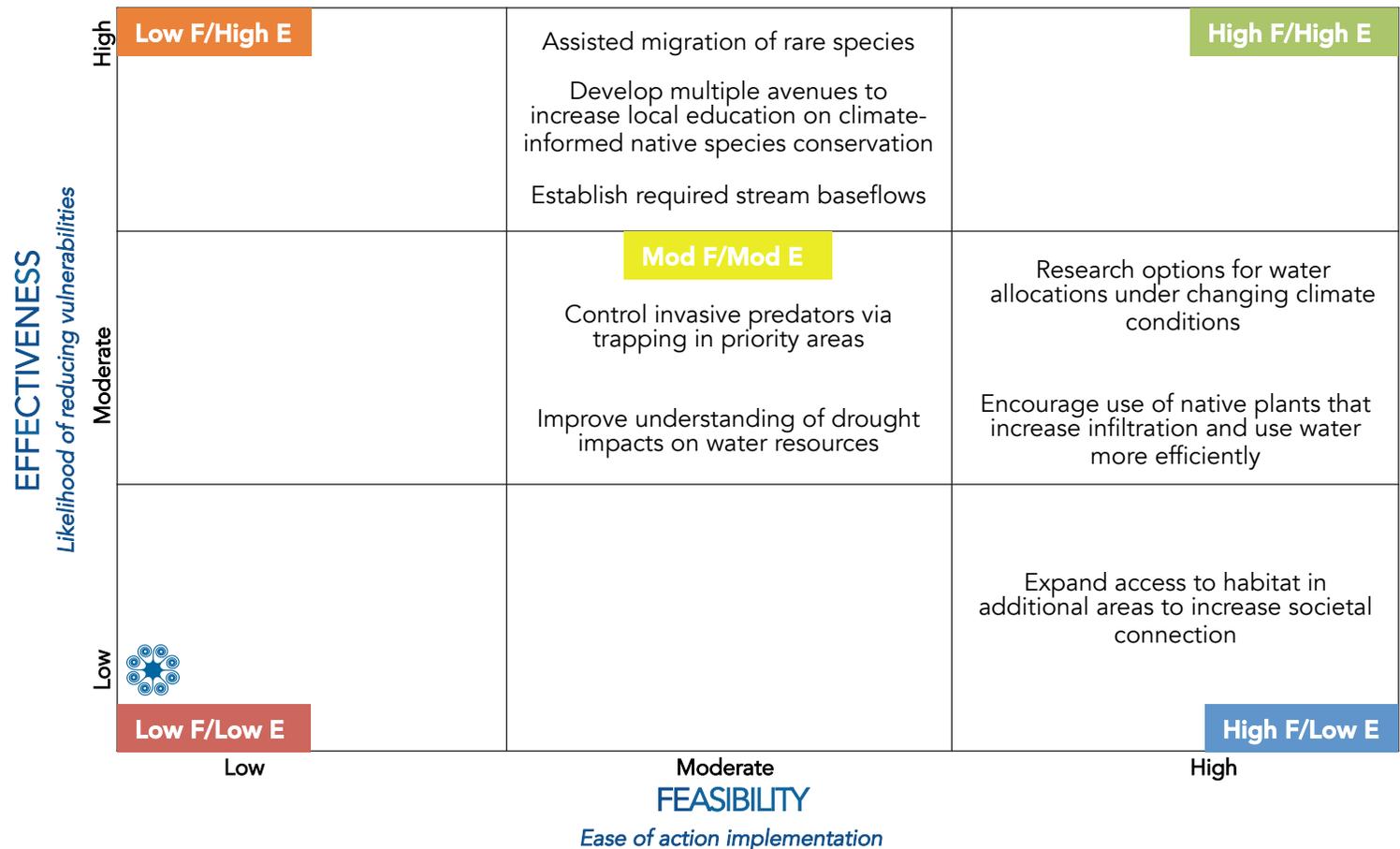
- + Vegetation somewhat adapted to variable hydrology, temperature, and salinity; waterbirds appear able to use artificial habitat
- + Some wetlands are highly managed and have protected status, which may buffer some impacts
- + Many wetland areas are being restored
- + Provide many ecosystem services

Factors that undermine adaptive capacity:

- Significant lowland wetland habitat loss since human settlement; irrigated agricultural fields and artificial wetlands comprise a large portion of remnant habitat area on Kaua'i
- Not resilient to hydrological alterations
- Host many endangered species, which may be more vulnerable to climate impacts
- May not be able to supplement wetlands with groundwater in a drier climate

ADAPTATION STRATEGIES FOR LOWLAND WETLAND HABITATS

Types of Adaptation Approaches	Adaptation Strategy	Specific Action
Resistance: Prevent climate change from affecting a resource. <i>Near-term approach</i>	Manage invasive species	<ul style="list-style-type: none"> Control invasive predators via trapping in priority areas (i.e. critical habitats)
Resilience: Help resources weather climate change by avoiding the effects of or recovering from changes <i>Near- to mid-term approach</i>	Maintain water availability	<ul style="list-style-type: none"> Establish required stream baseflows to maintain native stream species, cultural practices, and traditional rights Encourage use of native plants that increase infiltration and use water more efficiently
Response: Intentionally accommodate change and adaptively respond to variable conditions <i>Long-term approach</i>	Prepare for sea level rise impacts	<ul style="list-style-type: none"> Assisted migration of rare species
Knowledge: 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 allocation under changing climate conditions	<ul style="list-style-type: none"> Improve understanding of drought impacts on water resources Research options for water allocations under changing climate conditions
Collaboration: Coordinate efforts and capacity across landscapes and agencies <i>Near- to long-term approach</i>	Increase citizen outreach, education, and science to increase support for managing habitats in light of climate change	<ul style="list-style-type: none"> Develop multiple avenues to increase local education on climate-informed native species conservation Expand access to habitat in additional areas to increase societal connection



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. Lowland Wetland Habitats: Vulnerability and Adaptation Brief for Kaua'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.