Upland Wetland Habitats

Climate Vulnerability Assessment and Adaptation Strategies for O'ahu

HABITAT DESCRIPTION

Upland wetland habitats on O'ahu (i.e. bogs, swamps, marshes) occur in forest openings above 100 m (328 ft). These habitats receive significant moisture via rainfall, fog, and groundwater. They are small in size, and feature a mixture of mud, standing water pockets, and highly endemic and specialized species, including mosses, hummock-forming endemic sedges and grasses, and some dwarf woody plants. O'ahu's two significant upland wetland areas are the Mount Ka'ala summit plateau and Ka'au Crater.

EcoAdapt™

PACIFIC ISLANDS CLIMATE CHANGE COOPERATIVE

HABITAT VULNERABILITY

Precipitation, soil moisture, condensation levels, and drought affect water availability, which along with air temperature, affects vegetation survival, composition, and peat formation. Tropical storms, wildfire, and disease may also affect water delivery by impacting the condition of the broader water catchment, or affect wetland sediment input via erosion. Non-climate stressors such as invasive species (e.g., ungulates, flammable grasses, trees, shrubs) can further alter upland wetland vegetative composition by displacing native species or altering ecological processes (e.g., fire). Upland wetlands occupy only a small area on O'ahu, are structurally degraded by invasive species, and have limited room to migrate. However, vegetation appears somewhat resilient to disturbance and water fluctuations.

Drivers of Habitat Vulnerability

- **Climatic factors and disturbance regimes:** Precipitation amount & timing, soil moisture, drought, tropical storms/ hurricanes, condensation level, air temperature, wildfire, disease
- **Non-climate factors:** Invasive species (ungulates, flammable grasses, trees & shrubs)

PROJECTED FUTURE CHANGES	POTENTIAL IMPACTS ON UPLAND WETLAND HABITATS
Changes in **precipitation**; reduced **soil moisture**; changing **condensation levels**; variable **drought risk**	• Altered water table levels, impacting vegetative composition/productivity and peat accumulation • Increased wetland vegetation dieback and mortality during drier and hotter conditions, which may increase vulnerability to forest encroachment • Potential upland wetland loss or size contraction during persistent dry conditions • Increased fire risk during drier conditions
Increased **air temperatures** *+2°C (3.6°F) to +3.5°C (6.3°F) by 2100*	• Altered vegetative composition and increased risk of forest encroachment • Accelerated decomposition rates, altering peat accumulation • Increased avian malaria risk for upland birds by expanding mosquito distribution
Increased frequency and strength of **tropical storms/hurricanes**; increased **wildfire**; increased **disease**	• Storms and wildfire increase sediment input, affecting vegetative composition • Indirect effects by altering forest structure, water capture, and erosion patterns in water catchment

ADAPTIVE CAPACITY

Factors that enhance adaptive capacity:

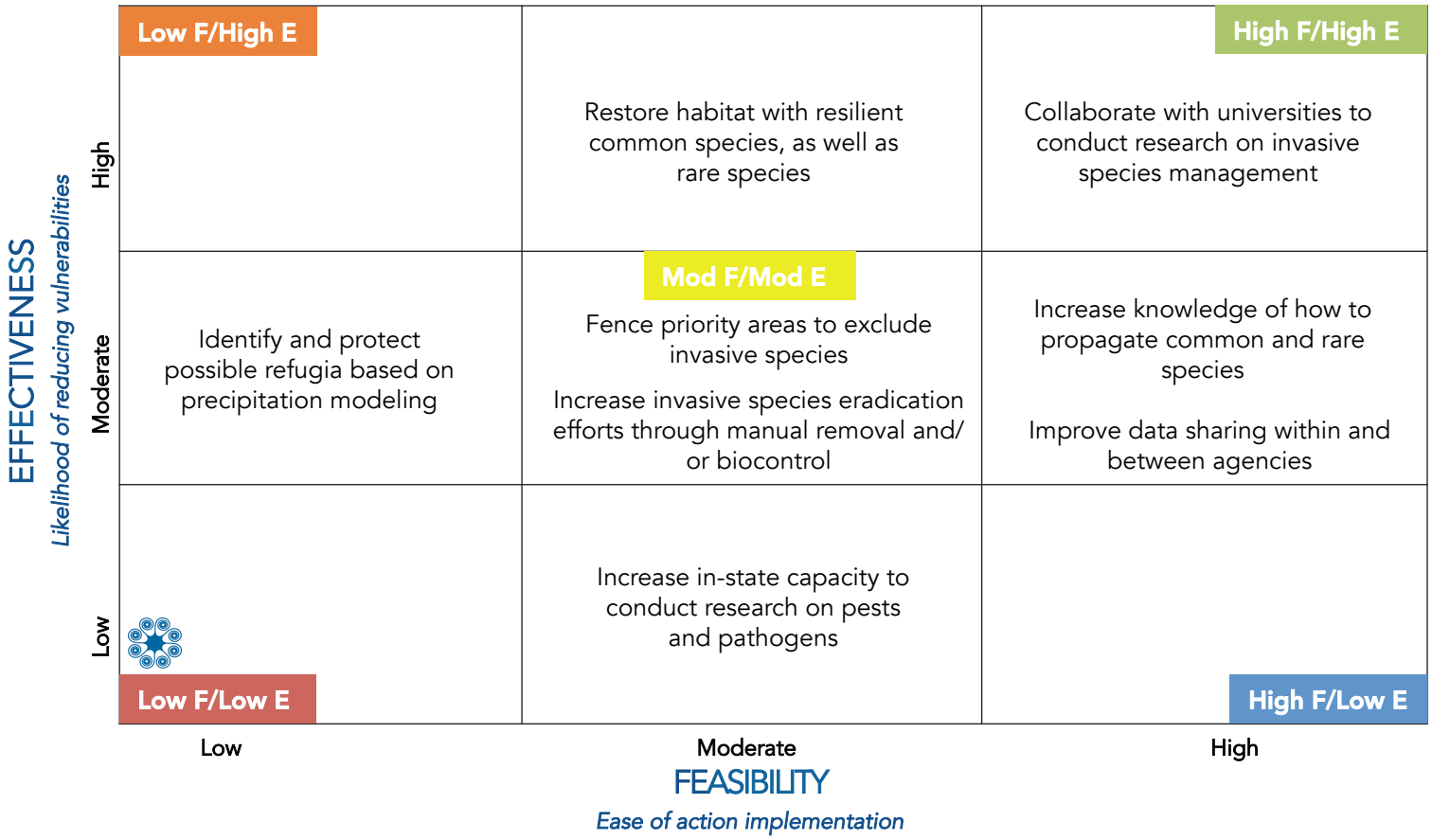
+ Some habitat areas are structurally and functionally intact (e.g., Ka'ala Bog)
+ Native vegetation is resilient and recovers when disturbance factors are removed
+ Some areas have protected status, which may bolster resilience and management options

Factors that undermine adaptive capacity:

– Small existing habitat area (1,378 acres; 5.58 km^2)
– High elevation location reduces opportunities for migration in response to climate impacts
– Restricted distribution of specialized and endemic species enhances vulnerability to extirpation
– Habitat not resilient to repeated disturbance

ADAPTATION STRATEGIES FOR UPLAND WETLAND HABITATS

Types of Adaptation Approaches	Adaptation Strategy	Specific Action
Resistance: Prevent climate change from affecting a resource. *Near-term approach*	Manage invasive species	• Fence priority areas to exclude invasive species within intact forest • Increase invasive species eradication efforts through manual removal and/or biocontrol of ungulates, predators, and plants with a high rate of spread
Resilience: Help resources weather climate change by avoiding the effects of or recovering from changes *Near- to mid-term approach*	Restore native habitat	• Restore habitat with resilient common species, as well as rare species
Response: Intentionally accommodate change and adaptively respond to variable conditions *Long-term approach*	Facilitate transition of species into new areas as climate regimes shift	• Identify and protect possible refugia based on precipitation modeling
Knowledge: Gather information about climate impacts and/or management effectiveness in addressing climate challenges *Near- to long-term approach*	Increase restoration capacity	• Increase in-state capacity to conduct research on pests and pathogens • Increase knowledge of how to propagate common and rare species
Collaboration: Coordinate efforts and capacity across landscapes and agencies *Near- to long-term approach*	Create new/improve partnerships to increase capacity	• Collaborate with universities to conduct research on invasive species management • Improve data sharing within and between agencies



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.

Hilberg LE, Gregg RM. 2018. Upland Wetland Habitats: Vulnerability and Adaptation Brief for O'ahu. EcoAdapt, Bainbridge Island, WA. Produced in cooperation with the Pacific Islands Climate Change Cooperative, with funding from the U.S. Fish and Wildlife Service.