# Lowland Wetland Habitats

*Climate Vulnerability Assessment and Adaptation Strategies for O'ahu*

## HABITAT DESCRIPTION

O'ahu's lowland wetland habitats include coastal freshwater marshes occurring below 100 m (328 ft). They feature perennial or seasonal ponded fresh water derived from precipitation, river and stream runoff, and groundwater inflow. Water levels fluctuate throughout the year, with the highest levels typically occurring during the winter wet season. Standing water is typically surrounded by emergent vegetation, including native sedges, 'aka'akai, pickleweed, cattail, and beach dropseed grass. O'ahu also supports vernal pools in dry, leeward lowlands. These wetlands provide important habitat for many species (e.g., endemic waterbirds, migratory shorebirds, fish, invertebrates).

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## HABITAT VULNERABILITY

Sea level rise, saltwater intrusion, precipitation, and drought are likely to affect wetland hydroperiod, salinity, and geographic extent, driving changes in vegetative composition and affecting suitability for wildlife. Warmer temperatures may affect plant germination, increase avian disease risk, and alter waterbird nesting success. Non-climate stressors (e.g., development, poisons, invasive vegetation, invasive ungulates) can reduce habitat extent and alter water quality and hydrological and sediment regimes. Other invasive species (amphibians, fish, mammalian predators) prey on and compete with native species. Wetlands provide many ecosystem services and have some regulatory support, but management is challenged by shifts in water availability, which could increase competition with other water uses.


### Drivers of Habitat Vulnerability

- **Climatic factors and disturbance regimes:** Sea level rise, coastal flooding, saltwater intrusion, precipitation amount, air temperature
- **Non-climate factors:** Invasive species (vegetation, mammalian predators, fish, ungulates, reptiles, birds, amphibians), residential & commercial development, pollution & poisons

| PROJECTED FUTURE CHANGES | POTENTIAL IMPACTS ON LOWLAND WETLAND HABITATS |
|---|---|
| **Sea level rise**; increased **coastal flooding** & **saltwater intrusion**<br>*+0.4 m (1.3 ft) to +3.3 m (10.8 ft) of sea level rise by 2100* | • Increased salinity, potentially causing shifts to more salt-tolerant vegetation, reduced vegetative species richness and cover by reducing seed germination, and reduced habitat utilization by wildlife<br>• Altered hydroperiod (i.e. increased ponding depth and duration)<br>• Reduced habitat availability if unable to migrate inland |
| Changes in **precipitation**; variable **drought risk**<br>*Increased drought in low elevation leeward areas; static risk elsewhere* | • Altered hydroperiod, impacting vegetative composition and cover<br>• Reduced soil moisture, stunting wetland plant growth and reducing plant survival<br>• Reduced habitat availability by preventing ponding of seasonal/ ephemeral wetlands<br>• Degraded habitat conditions due to reduced system flushing; stagnant water may increase avian botulism incidence<br>• Drier conditions enhance fire risk and may promote invasive vegetation |
| Increased **air temperatures**<br>*+2°C (3.6°F) to +3.5°C (6.3°F) by 2100* | • Potential reductions in plant germination, particularly in concert with saline conditions<br>• Increased disease incidence (e.g., avian botulism)<br>• Increased waterbird egg mortality, reducing nesting success |

## ADAPTIVE CAPACITY

**Factors that enhance adaptive capacity:**

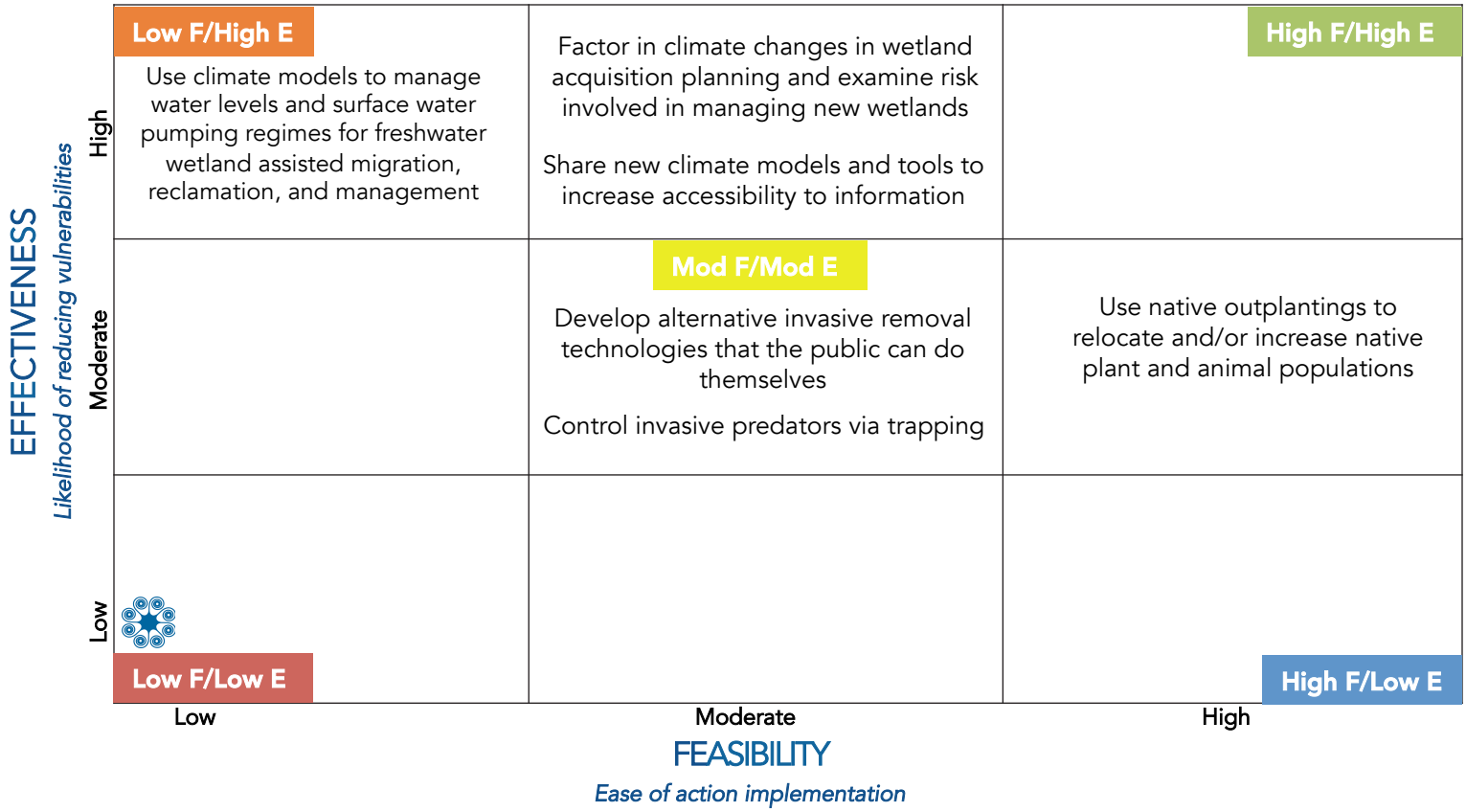
+ Some wetland areas have protected status and are highly managed, which may buffer impacts
+ Wetland vegetation is somewhat resilient to variable conditions
+ Wetlands provide many ecosystem services
+ Wetlands have some regulatory support (e.g., "no net loss of wetlands")

**Factors that undermine adaptive capacity:**

– 71% of pre-settlement lowland wetland area has been lost to human development and agricultural land use
– Dependent on human management to recover from and be resilient to invasive species and altered hydrology
– Some management actions (e.g., pumping groundwater to supplement wetlands) may not be feasible 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<br>*Near-term approach* | Manage invasive species | • Control invasive predators via trapping |
| **Resilience**: Help resources weather climate change by avoiding the effects of or recovering from changes<br>*Near- to mid-term approach* | Maintain and augment native species populations | • Use native outplantings to relocate and/or increase native plant and animal populations |
| **Response**: Intentionally accommodate change and adaptively respond to variable conditions<br>*Long-term approach* | Create new wetlands to buffer climate-related habitat change | • Factor in climate changes in wetland acquisition planning and examine risk involved in managing new wetlands<br>• Use climate models to manage water levels and surface water pumping regimes for freshwater wetland assisted migration, reclamation, and management |
| **Knowledge**: Gather information about climate impacts and/or management effectiveness in addressing climate challenges<br>*Near- to long-term approach* | Develop more efficient technologies/tools for habitat restoration and invasive species control | • Develop alternative removal technologies that the public can do themselves |
| **Collaboration**: Coordinate efforts and capacity across landscapes and agencies<br>*Near- to long-term approach* | Improve science-management communication and partnerships | • 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.*

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