# Flood & Erosion Control

*Climate Vulnerability Assessment and Adaptation Strategies for Kaua'i*

## ECOSYSTEM SERVICE DESCRIPTION

Native terrestrial and aquatic ecosystems help regulate flooding and erosion by regulating surface and subsurface flow, storing and reducing rates of water discharge, and anchoring and retaining sediment. For example, Kaua'i's native forests intercept rain, slow runoff, and anchor forest sediment, and wetlands help slow floodwater velocity and attenuate sediment, thereby decreasing erosion. Coastal ecosystems also help buffer flooding and erosion by anchoring coastal sediment and altering wave dynamics.

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## ECOSYSTEM SERVICE VULNERABILITY

Climatic factors (e.g., extreme precipitation) can overwhelm the capacity of Kaua'i's habitats to provide this service. Other factors (e.g., drought, wildfire, tropical storms) affect this service by altering vegetative cover and composition and increasing exotic species. Non-climate stressors often alter sheet flow and surface runoff patterns, increasing flood volumes, and also increase erosion potential by reducing native vegetative cover. Some non-climate stressors (e.g., water diversions, groundwater withdrawals) may benefit flood control to a small degree. Watershed restoration, best management practices, and land protection enhance this service, but management opportunities will be affected by funding, regulatory frameworks, and public-private land cooperation.

| PROJECTED FUTURE CHANGES BY 2100 | POTENTIAL IMPACTS ON FLOOD AND EROSION CONTROL |
|---|---|
| Increased frequency and strength of **tropical storms/ hurricanes;** uncertain change in **extreme precipitation events** | • Increased flash flooding and erosion, especially in areas without native forest<br>• Increased risk of large land-wasting events<br>• Storms increase coastal inundation and erosion |
| Variable **drought risk** (increased in low elevation leeward areas, decreased at high elevations); reduced **soil moisture** | • May temporarily reduce flooding, but undermines long-term flood and erosion protection by degrading native forests and other habitats<br>• Dry conditions increase fire risk and may promote exotic species, reducing flood and erosion control |
| **Sea level rise** *+0.4 m (1.3 ft) to +3.3 m (10.8 ft) of sea level rise by 2100* | • Increased coastal erosion<br>• Increased coastal flooding by impairing drainage and reducing habitat water storage capacity |
| Reduced **baseflows**; increasingly variable **riverine flooding** | • Altered streamflows may ameliorate flooding<br>• High flows increase coastal flooding and can cause beach erosion |
| Increased **wildfire** | • Increased erosion and landslide potential by removing vegetation<br>• Increased flooding and decreased water infiltration<br>• May promote exotic species, undermining this service |


### Drivers of Ecosystem Service Vulnerability

- **Climatic factors and disturbance regimes:** Extreme precipitation events, drought, soil moisture, tropical storms/ hurricanes, sea level rise, streamflow, riverine flooding,wildfire
- **Non-climate factors:** Residential & commercial development, agriculture & aquculture, pollution & poisons, roads/ highways/trails, water diversions, recreation, invasive species (flammable grasses, ungulates, trees & shrubs), stream hardening, coastal stressors

## ADAPTIVE CAPACITY

### Factors that enhance adaptive capacity:

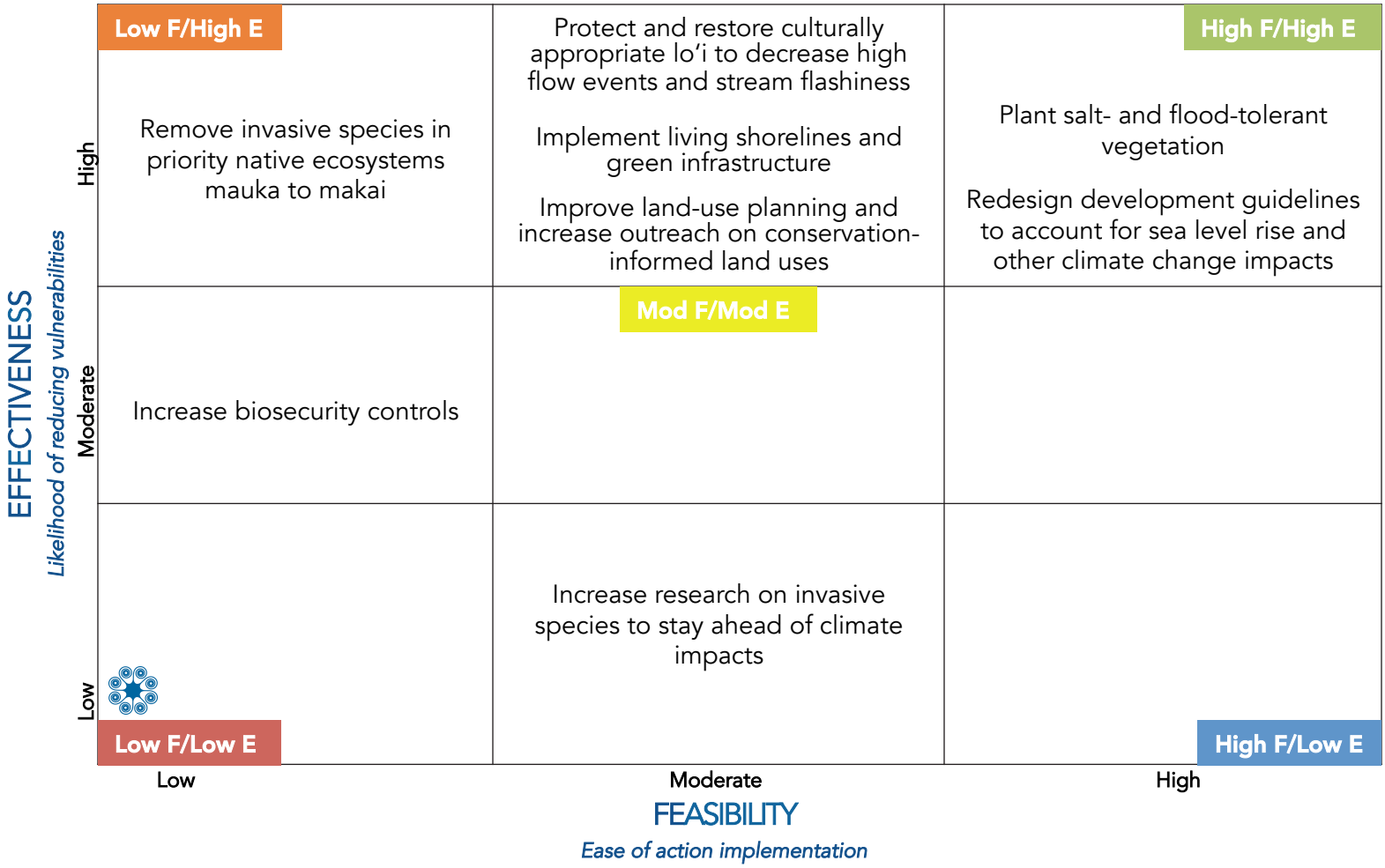
+ Restoration activities and best management practices may increase service resilience
+ Provides mutual benefits to fresh water ecosystem service and aquatic habitats
+ Some habitats that provide this service are protected and highly managed, which may help buffer some impacts

### Factors that undermine adaptive capacity:

– Land ownership influences management potential; need enhanced collaboration between public and private land owners
– Coastal impacts are more difficult to manage, and some management options have negative impacts (e.g., armoring)
– Societal support for managing and maintaining this service varies depending on extent of impact to human populations

# ADAPTATION STRATEGIES FOR FLOOD & EROSION CONTROL

| Types of Adaptation Approaches | Adaptation Strategy | Specific Action |
|---|---|---|
| **Resistance**: Prevent climate change from affecting a resource. *Near-term approach* | Manage invasive species | • Remove invasive species in priority native ecosystems mauka to makai<br>• Increase biosecurity controls |
| **Resilience**: Help resources weather climate change by avoiding the effects of or recovering from changes *Near- to mid-term approach* | Promote technical and cultural practices to reduce stream flashiness | • Protect and restore culturally appropriate lo'i to decrease high flow events and stream flashiness |
| **Response**: Intentionally accommodate change and adaptively respond to variable conditions *Long-term approach* | Prepare for sea level rise impacts | • Implement living shorelines and green infrastructure<br>• Redesign development guidelines to account for sea level rise and other climate change impacts<br>• Plant salt- and flood-tolerant vegetation |
| **Knowledge**: Gather information about climate impacts and/or management effectiveness in addressing climate challenges *Near- to long-term approach* | Remove and prevent invasive species | • Increase research on invasive species to stay ahead of climate impacts |
| **Collaboration**: Coordinate efforts and capacity across landscapes and agencies *Near- to long-term approach* | Reduce human pressure on native ecosystems | • Improve land-use planning and increase outreach on conservation-informed land uses |




*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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