

Flood & Erosion Control

Climate Vulnerability Assessment and Adaptation Strategies
for Maui, Lānaʻi, and Kahoʻolawe

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 to water bodies, and anchoring and retaining sediment. For example, wetlands help slow floodwater velocity and attenuate sediment, and native forests intercept rain, slow runoff, and anchor sediment. Although not considered in this assessment, coastal ecosystems also help mitigate flooding and erosion by anchoring coastal sediment and altering wave dynamics.



ECOSYSTEM SERVICE VULNERABILITY

Climatic changes such as extreme precipitation and flash flood events can overwhelm the capacity of this service, while other changes such as drought and wildfire impair or alter native ecosystems, affecting their ability to provide flood and erosion control. Non-climate stressors such as residential and commercial development, roads, highways, trails, recreation, and water diversions increase streamflow volumes and velocity by increasing sheet flow and altering surface runoff patterns. These stressors, along with agricultural land use and invasive species (e.g., grasses, ungulates, trees), also reduce native vegetative cover and increase bare ground, exacerbating erosion potential. Best management practices in human land-use areas will help maintain this service, but public support for enhanced service management is needed.



Drivers of Ecosystem Service Vulnerability

- **Climatic factors and disturbance regimes:** Extreme precipitation events, drought, wildfire
- **Non-climate factors:** Residential & commercial development, agriculture & aquaculture, roads/highways/trails, water diversions, recreation, invasive species (flammable grasses, ungulates, trees & shrubs)

PROJECTED FUTURE CHANGES	POTENTIAL IMPACTS ON FLOOD AND EROSION CONTROL
Uncertain changes in the frequency & intensity of extreme precipitation events	<ul style="list-style-type: none"> • Increased flash flooding if extreme precipitation events increase, particularly in areas with altered and degraded forests, streams, and wetlands • Increased sheet flow and erosion, particularly in areas where native forest cover has been lost • Increased vulnerability to large land wasting events
Variable drought risk (increased in low- and mid-elevation leeward areas; decreased at mid-elevation windward areas)	<ul style="list-style-type: none"> • May temporarily reduce flooding, but drought impairs long-term flood and erosion control by altering native forest integrity, composition, and distribution • Increased wildfire risk
Increased wildfire	<ul style="list-style-type: none"> • Loss of woody vegetation cover as a result of too-frequent burning can increase downstream flooding by reducing infiltration and decreasing water table depth • Facilitates the establishment and dominance of invasive vegetation, which can change watershed characteristics including flood and erosion control

ADAPTIVE CAPACITY

Factors that enhance adaptive capacity:

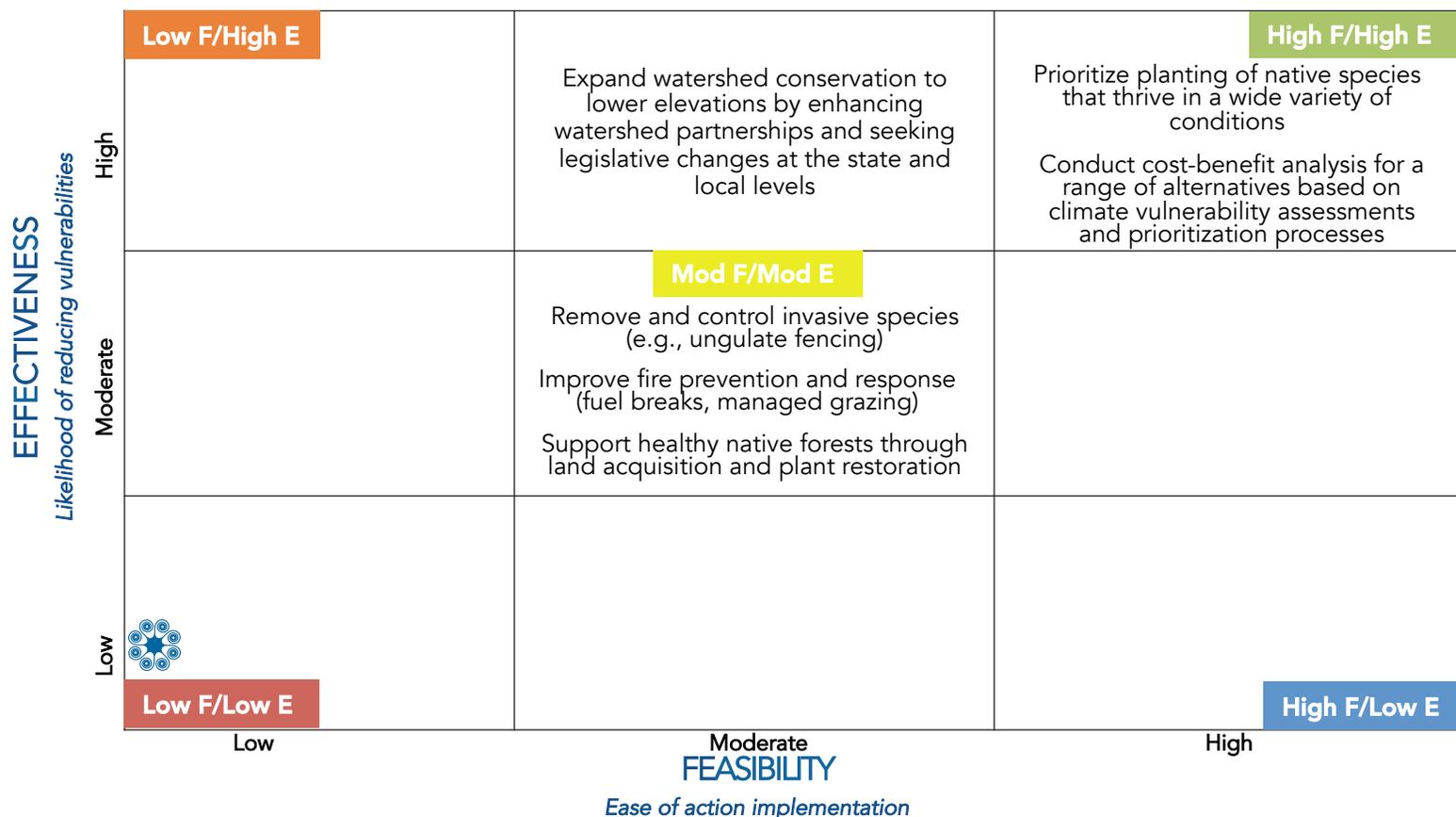
- + Some habitats that are valued for and provide this service are protected and actively managed
- + Management of this service is supported by federal/state agencies and watershed partnerships
- + Best management practices, such as ungulate removal and stormwater drainage, may buffer some impacts (e.g., reduce erosion) by promoting infiltration

Factors that undermine adaptive capacity:

- Likelihood of alleviating impacts dependent on political will and better land use decision-making
- Enhanced management also requires strong public commitment and willingness to change behavior to protect flood and erosion control services

ADAPTATION STRATEGIES FOR FLOOD & EROSION CONTROL

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"> Use fencing in critical watersheds to exclude ungulates from upland forest areas Remove invasive plants (e.g., Miconia)
	Improve fire prevention and response	<ul style="list-style-type: none"> Use managed grazing and fuel treatments to limit potential wildfire Maintain fuel breaks below power lines and on road sides
Resilience: Help resources weather climate change by avoiding the effects of or recovering from changes <i>Near- to mid-term approach</i>	Protect forests to increase recharge and water retention	<ul style="list-style-type: none"> Support healthy native forests through land acquisition and plant restoration
Response: Intentionally accommodate change and adaptively respond to variable conditions <i>Long-term approach</i>	Facilitate transition of species into new areas as climate regimes shift	<ul style="list-style-type: none"> Prioritize the planting of native species that thrive in a wide variety of conditions (e.g., generalists, resilient species)
Knowledge: Gather information about climate impacts and/or management effectiveness in addressing climate challenges <i>Near- to long-term approach</i>	Anticipate and facilitate habitat migration	<ul style="list-style-type: none"> Conduct a cost-benefit analysis for a range of alternatives based on climate change vulnerability assessments and prioritization processes
Collaboration: Coordinate efforts and capacity across landscapes and agencies <i>Near- to long-term approach</i>	Increase collaborative efforts to conserve streams and watersheds	<ul style="list-style-type: none"> Expand watershed conservation to lower elevations by enhancing watershed partnerships and seeking legislative changes at the state and local levels



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. Flood & Erosion Control: Vulnerability and Adaptation Brief for Maui, Lāna'i, and Kaho'olawe. EcoAdapt, Bainbridge Island, WA.

Produced in cooperation with the Pacific Islands Climate Change Cooperative, with funding from the U.S. Fish and Wildlife Service.