Fresh Water

Climate Vulnerability Assessment and Adaptation Strategies for Maui, Lāna'i, and Kaho'olawe

ECOSYSTEM SERVICE DESCRIPTION

Fresh water is a provisioning ecosystem service because it supplies both consumptive (e.g., drinking water) and non-consumptive (e.g., power generation) human uses. Native habitats help maintain water supply by intercepting, slowing, and storing water, and enhance water quality by filtering pollutants and anchoring sediment. For example, the west Maui mountains can provide up to 25.55 billion gallons of water per year. On Maui, groundwater is utilized for public drinking water, while surface water has historically been predominantly used for irrigation.

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ECOSYSTEM SERVICE VULNERABILITY

Climatic changes, such as increasing drought frequency and severity, increasing precipitation variability, and warmer air temperatures are likely to reduce fresh water supply, and sea level rise may impair water quality. Wildfire and disease may reduce or alter native vegetation, impairing water capture and filtration. Non-climate stressors alter water use and delivery, and human land use can impair water quality by introducing contaminants or alter water capture by increasing runoff and introducing invasive species. Invasive species undermine watershed health and integrity, decreasing water storage and quality. Fresh water is highly valued by the public, and native landscape protection may help maintain this service in the future. However, diverse uses of fresh water increases management challenges.

Drivers of Ecosystem Service Vulnerability

- **Climatic factors and disturbance regimes:** Sea level rise, saltwater intrusion, precipitation amount & timing, drought, air temperature, wind and circulation, wildfire, flooding, disease
- **Non-climate factors:** Residential & commercial development, agriculture & aquaculture, pollution & poisons, roads/highways/trails, water diversions, recreation, invasive species (parasites/pathogens, ungulates, trees & shrubs)

PROJECTED FUTURE CHANGES	POTENTIAL IMPACTS ON FRESH WATER
Sea level rise; increased **saltwater intrusion** *+0.4 m (1.3 ft) to +3.3 m (10.8 ft) of sea level rise by 2100*	• Increased groundwater salinity • Not likely to exert large influences on overall water availability
Changes in **precipitation**; variable **drought** risk *(increased in low- and mid-elevation leeward areas; decreased at mid-elevation windward areas)*	• Drier conditions reduced surface water availability and groundwater recharge/storage • Drier conditions increase wildfire risk
Increased **air temperature** *+2.0°C (3.6°F) to +3.5°C (6.3°F), with greater increases at high elevations*	• Increased evaporation, reducing water availability; impacts will be more acute if precipitation declines
Changes in **wind** & **circulation**	• Reduced rainfall, decreasing water availability and groundwater recharge
Increased **wildfire**	• Reduced water quality due to enhanced erosion and sedimentation • Increased invasive plants, reducing water capture, storage, and infiltration
Increasingly variable **riverine flooding**	• Temporarily impaired water quality following flash floods
Increased **disease**	• Increased native tree mortality, affecting water capture and infiltration

ADAPTIVE CAPACITY

Factors that enhance adaptive capacity:

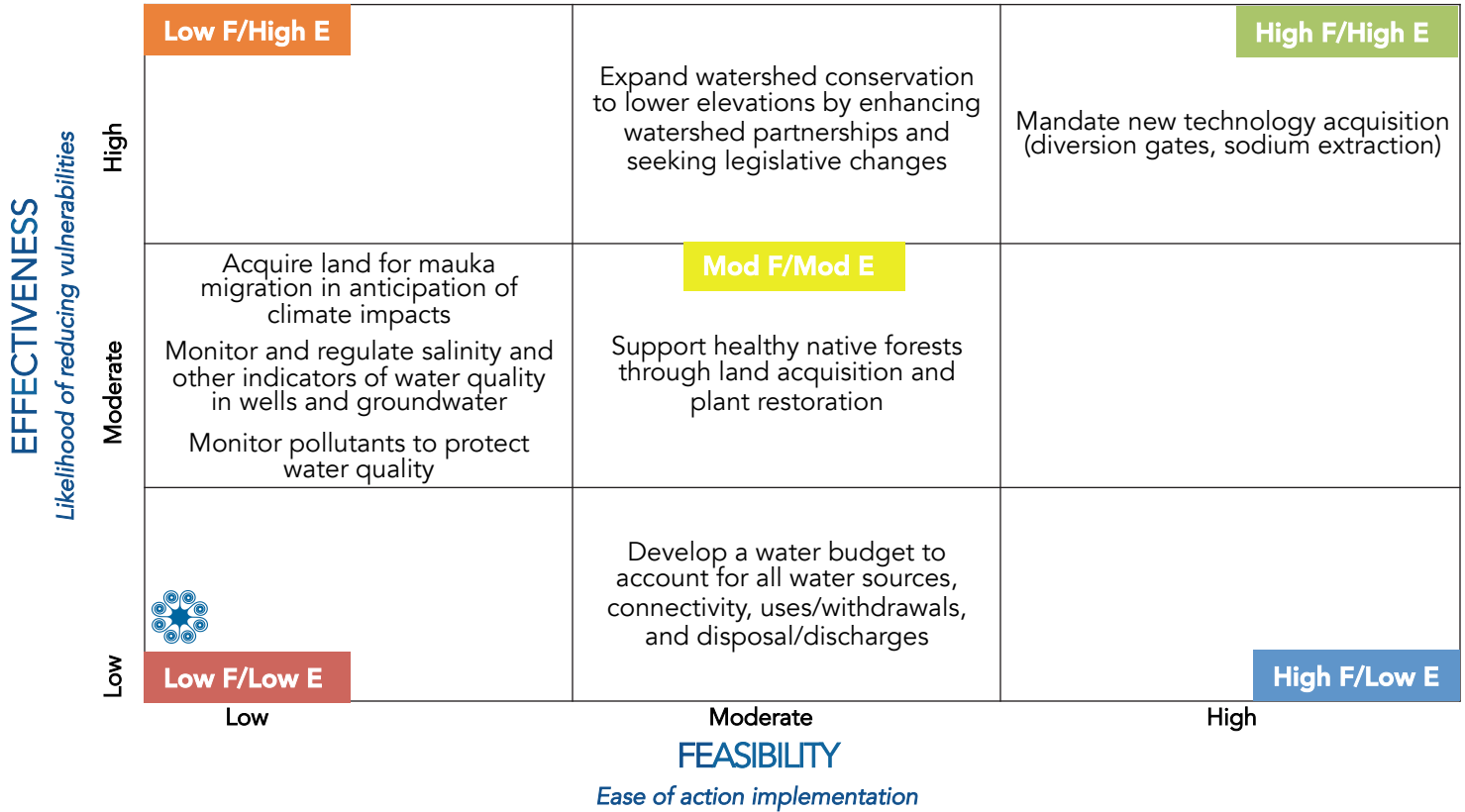
+ High public value and societal support for management and conservation of water resources
+ Water use and conservation can be managed to enhance resilience
+ Native forest restoration and efforts by watershed partnerships may help maintain surface water availability in a warmer and drier climate

Factors that undermine adaptive capacity:

– Fresh water is required for both natural systems and human uses, which can have conflicting management priorities
– Shifts in Maui's economy are likely to alter water demand and management
– Fresh water is a public trust, but water infrastructure is privately managed

ADAPTATION STRATEGIES FOR FRESH WATER

Types of Adaptation Approaches	Adaptation Strategy	Specific Action
Resistance: Prevent climate change from affecting a resource. *Near-term approach*	Improve water conservation efforts	• Develop a water budget to account for all water sources, connectivity, uses/ withdrawals, and disposal/discharges
Resilience: Help resources weather climate change by avoiding the effects of or recovering from changes *Near- to mid-term approach*	Protect forests to increase recharge and water retention	• Support healthy native forests through land acquisition and plant restoration
	Mandate acquisition of new technologies to maintain and enhance water quality	• Extract sodium to increase freshwater supplies • Install diversion gates
Response: Intentionally accommodate change and adaptively respond to variable conditions *Long-term approach*	Increase ecosystem resilience, connectivity, and integrity	• Acquire land for mauka migration in anticipation of sea level rise, increasing temperatures, and precipitation changes
Knowledge: Gather information about climate impacts and/or management effectiveness in addressing climate challenges *Near- to long-term approach*	Monitor pollutants to protect water quality	• Monitor point- and non-point source pollutants associated with agriculture and development • Monitor and regulate salinity and other indicators of water quality in wells and groundwater
Collaboration: Coordinate efforts and capacity across landscapes and agencies *Near- to long-term approach*	Increase collaborative efforts to conserve streams and watersheds	• 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.

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