

Fresh Water

Climate Vulnerability Assessment and Adaptation Strategies for O'ahu

ECOSYSTEM SERVICE DESCRIPTION

Fresh water is classified as a provisioning ecosystem service because it supplies both consumptive (e.g., drinking water, agricultural and industrial use) and non-consumptive (e.g., power generation) human uses. Native forests, wetlands, and other habitats help maintain fresh water supply by intercepting, slowing, and storing water, and also enhance water quality by anchoring and filtering sediment and filtering pollutants. For example, O'ahu's forested Ko'olau Mountains provide an estimated 133 billion gallons of water per year. Wai'anae and Ko'olau are O'ahu's primary aquifers, with central O'ahu providing a majority of the island's groundwater resources. O'ahu also has extensive surface water resources in the form of perennial and intermittent streams and freshwater wetlands.



ECOSYSTEM SERVICE VULNERABILITY

Drought, warmer air temperatures, and altered storm and extreme precipitation events may reduce water supply, and along with sea level rise and flooding, may impair water quality. Wind, wildfire, insects, and disease have the potential to alter groundwater infiltration and surface runoff quality by affecting forest health and composition. Non-climate stressors alter water use and delivery, potentially compounding future climate-driven water reductions. Human land uses also impair water quality by introducing contaminants, and affect water capture by increasing runoff and introducing invasive species. Fresh water has high public value and there are several statewide and island-based water conservation and watershed health efforts. However, increasing population growth and variable enforcement of laws and policies will challenge management.



Low Moderate High

Drivers of Ecosystem Service Vulnerability

- **Climatic factors and disturbance regimes:** Extreme precipitation events, tropical storms/hurricanes, sea level rise, saltwater intrusion, drought, air temperature, wind, flooding, wildfire, insects, disease
- **Non-climate factors:** Development, agriculture & aquaculture, pollution, energy production, roads/highways/trails, water diversions, recreation, invasive species, population growth

PROJECTED FUTURE CHANGES	POTENTIAL IMPACTS ON FRESH WATER
Uncertain change in extreme precipitation events ; increased frequency & strength of tropical storms/hurricanes ; increasingly variable riverine flooding	<ul style="list-style-type: none"> • Increased surface runoff and groundwater recharge • Storm damage to canopy may reduce water interception and storage • Reduced surface water quality by promoting contaminant runoff
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	<ul style="list-style-type: none"> • Increased groundwater salinity
Variable drought risk ; increased trade wind inversion frequency	<ul style="list-style-type: none"> • Reduced water availability • Drier conditions may promote non-native plants, affecting watershed hydrology and increasing fire risk
Increased air temperatures +2.0°C (3.6°F) to +3.5°C (6.3°F), with greater increases at high elevations	<ul style="list-style-type: none"> • Increased evaporation and evapotranspiration, reducing water availability, particularly when paired with decreased precipitation
Increased wildfire	<ul style="list-style-type: none"> • High heat reduces soil permeability, reducing groundwater recharge • Impairs water quality by increasing runoff and erosion
Increased insects and disease	<ul style="list-style-type: none"> • May reduce water supply and quality by altering distribution, cover, and composition of native forests

ADAPTIVE CAPACITY

Factors that enhance adaptive capacity:

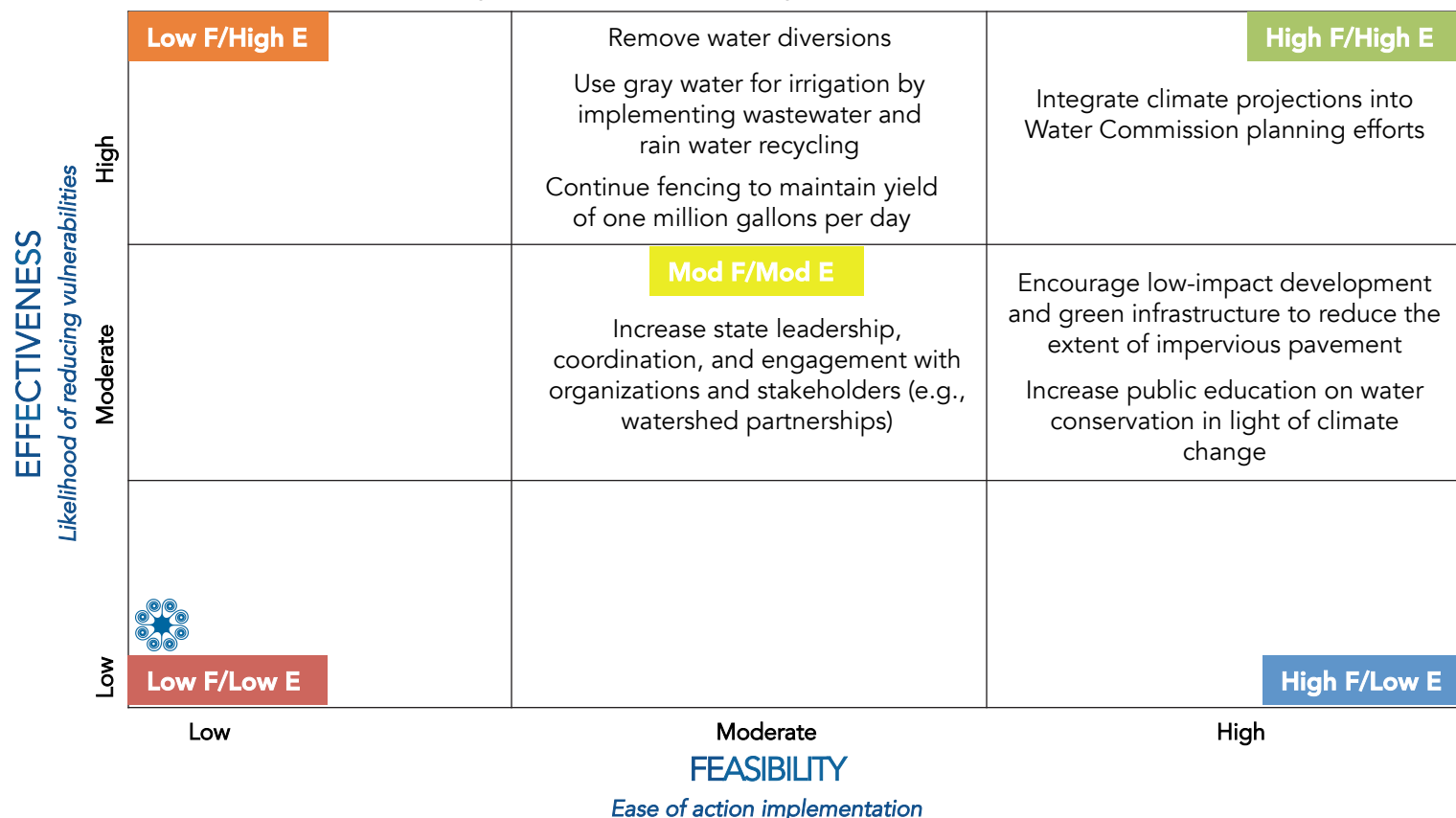
- + Ecosystem service has high public value
- + Shares mutual benefits with other services (e.g., flood and erosion control)
- + There are some statewide and island-based efforts promoting water conservation and enhanced water quality

Factors that undermine adaptive capacity:

- Existing laws and regulations are not enforced and need more funding
- Population growth will challenge future service management, especially when paired with climate change
- Faces uses conflicts with other services (e.g., recreation, hunting, cultural practices)
- Low native forest resilience undermines service resilience

ADAPTATION STRATEGIES FOR FRESH WATER

Types of Adaptation Approaches	Adaptation Strategy	Specific Action
Resistance: Prevent climate change from affecting a resource. <i>Near-term approach</i>	Reduce non-climate stressors that limit water supply	<ul style="list-style-type: none"> Continue fencing to maintain water yields of one million gallons per day Use gray water for irrigation by implementing wastewater and rain water recycling Remove water diversions
Resilience: Help resources weather climate change by avoiding the effects of or recovering from changes <i>Near- to mid-term approach</i>	Maintain/improve water quantity and quality	<ul style="list-style-type: none"> Encourage low-impact development and green infrastructure to reduce the extent of impervious pavement
Response: Intentionally accommodate change and adaptively respond to variable conditions <i>Long-term approach</i>	Maintain a resilient water supply	<ul style="list-style-type: none"> Integrate climate projections into Water Commission planning efforts
Knowledge: Gather information about climate impacts and/or management effectiveness in addressing climate challenges <i>Near- to long-term approach</i>	Collect data on existing non-climate stressors	<ul style="list-style-type: none"> Increase public education (industries, agriculture, residents, tourists) on water conservation in light of climate change (i.e. integrate messaging into water bills)
Collaboration: Coordinate efforts and capacity across landscapes and agencies <i>Near- to long-term approach</i>	Create new/improve existing partnerships to increase capacity	<ul style="list-style-type: none"> Increase state leadership, coordination, and engagement with organizations and stakeholders (e.g., watershed partnerships)



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.