

Fresh Water

Climate Vulnerability Assessment and Adaptation Strategies for Kaua'i

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. Kaua'i's native forests, wetlands, and other habitats help maintain water supply by intercepting, slowing, and storing water, and also enhance water quality by anchoring and filtering sediment and filtering pollutants. Kaua'i has extensive groundwater resources that supply human uses, as well as significant surface water resources in the form of perennial and intermittent streams and freshwater wetlands that support native wildlife and agricultural irrigation.



ECOSYSTEM SERVICE VULNERABILITY

Climatic changes are likely to affect future fresh water availability, and disturbance regimes may impact water availability, storage and quality by affecting watershed integrity and vegetative composition. Non-climate stressors alter water use and delivery, potentially compounding future climate-driven reductions in water availability. Human land uses (e.g., roads, urban areas) and activities (e.g., recreation) also impair water quality by introducing contaminants, and affect water capture by increasing runoff and introducing invasive species, which undermine watershed health and integrity. There are several statewide and island-based efforts focused on water conservation and watershed health, but society currently views fresh water as an unlimited resource.



Low Moderate High

Drivers of Ecosystem Service Vulnerability

- **Climatic factors and disturbance regimes:** Precipitation amount & timing, air temperature, drought, sea level rise, wildfire, streamflow, riverine flooding, wind & circulation, disease
- **Non-climate factors:** Residential & commercial development, agriculture & aquaculture, pollution & poisons, energy production, roads/highways/trails, water diversions, groundwater development, recreation, invasive species (flammable grasses, mammalian predators, ungulates, trees & shrubs, social insects)

PROJECTED FUTURE CHANGES	POTENTIAL IMPACTS ON FRESH WATER
<p>Changes in precipitation; variable drought risk</p> <p><i>Increased in low elevation leeward areas, decreased at high elevations</i></p>	<ul style="list-style-type: none"> • Reduced rainfall and drought will reduce surface and groundwater availability and may reduce groundwater quality by shrinking freshwater lens • Drought degrades native forests, impacting water capture and infiltration • Drought conditions enhance fire risk
<p>Increased air temperatures</p> <p>+2.0°C (3.6°F) to +3.5°C (6.3°F)</p>	<ul style="list-style-type: none"> • Reduced water availability by increasing evaporative demand
<p>Sea level rise</p> <p>+0.4 m (1.3 ft) to +3.3 m (10.8 ft) of sea level rise</p>	<ul style="list-style-type: none"> • Increased groundwater salinity
<p>Increased wildfire</p>	<ul style="list-style-type: none"> • Removes vegetation and promotes exotic species, which alters water capture/infiltration • Reduces water quality by increasing runoff and erosion
<p>Increasingly variable riverine flooding</p>	<ul style="list-style-type: none"> • Floods impair water quality
<p>Changes in wind & circulation</p>	<ul style="list-style-type: none"> • More frequent trade wind inversions will likely reduce water supply by affecting rainfall
<p>Increased disease</p>	<ul style="list-style-type: none"> • May alter surface runoff and groundwater infiltration by increasing native tree mortality and promoting exotic species

ADAPTIVE CAPACITY

Factors that enhance adaptive capacity:

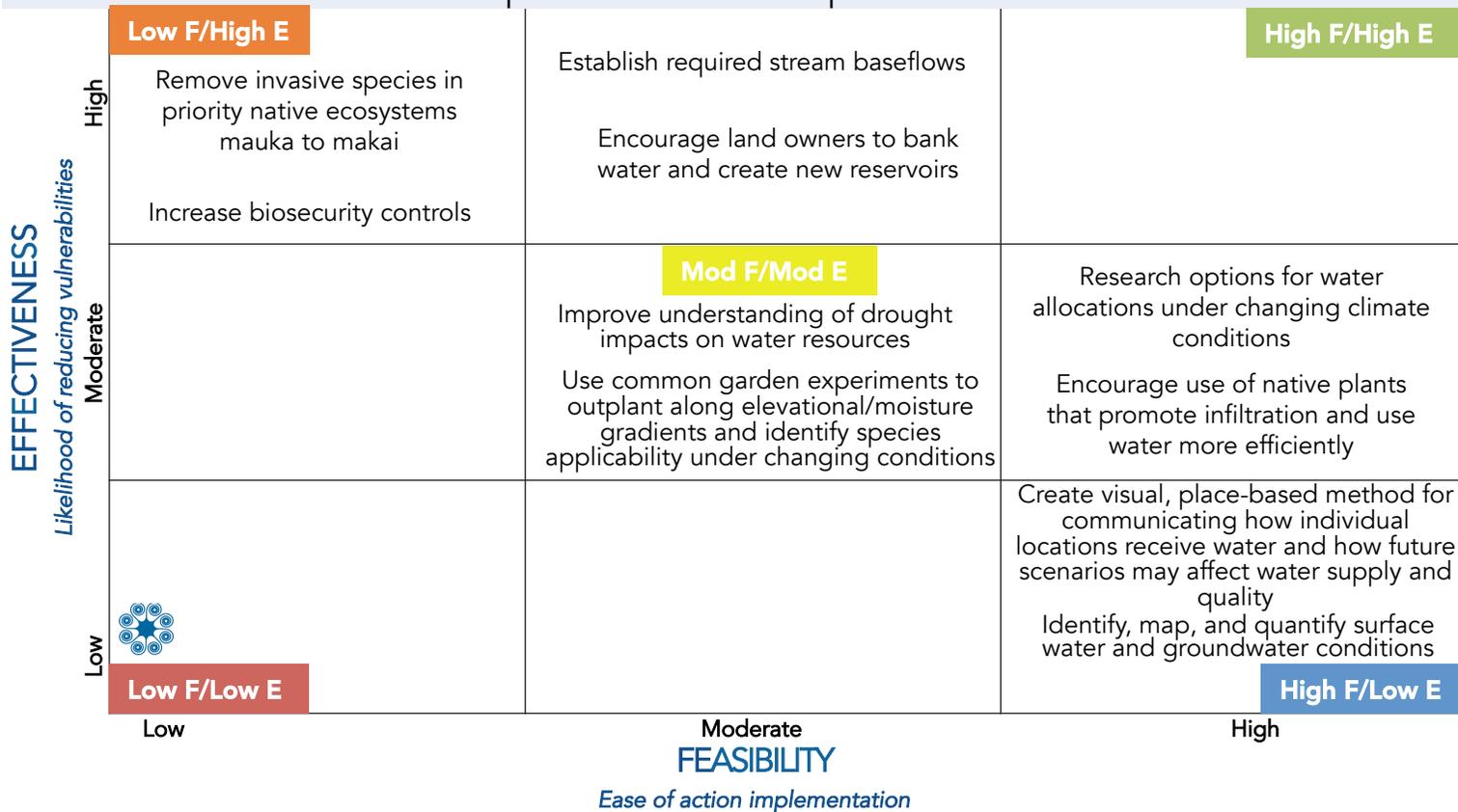
- + Watershed alliances, watershed management plans, and best management practices may increase service resilience
- + Statewide water conservation efforts may increase service resilience
- + Some habitats that provide this service are protected and highly managed, which may help buffer some impacts

Factors that undermine adaptive capacity:

- Freshwater viewed as an unlimited resource
- Societal support for ecosystem service management largely depends on whether residents feel impacted (e.g., water costs increase)

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>	Manage invasive species	<ul style="list-style-type: none"> • Increase biosecurity controls • Remove invasive species in priority native ecosystems mauka to makai
Resilience: Help resources weather climate change by avoiding the effects of or recovering from changes <i>Near- to mid-term approach</i>	Maintain water availability	<ul style="list-style-type: none"> • Establish required stream baseflows to maintain native stream species • Encourage use of native plants that promote infiltration and use water more efficiently • Encourage landowners to bank water and create new reservoirs
Response: Intentionally accommodate change and adaptively respond to variable conditions <i>Long-term approach</i>	Identify and promote climate-adapted species composition	<ul style="list-style-type: none"> • Use common garden experiments to outplant along elevational/moisture gradients and identify species applicability under changing conditions
Knowledge: Gather information about climate impacts and/or management effectiveness in addressing climate challenges <i>Near- to long-term approach</i>	Increase understanding of water quantity, quality, and allocations under changing climate conditions	<ul style="list-style-type: none"> • Identify, map, and quantify surface water and groundwater conditions • Improve understanding of drought impacts on water resources • Research options for water allocations under changing climate conditions
Collaboration: Coordinate efforts and capacity across landscapes and agencies <i>Near- to long-term approach</i>	Increase public understanding of water cycle and how humans interact with island-wide water resources	<ul style="list-style-type: none"> • Create visual, place-based method for communicating how individual locations receive water and how future scenarios may affect water supply and quality



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.