

# Mesic & Wet Forest Habitats

Climate Vulnerability Assessment and Adaptation Strategies for O'ahu

## HABITAT DESCRIPTION

Mesic forests on O'ahu occur at mid-elevation sites from 573–792 m (1,879–2,598 ft) in the leeward Wai'anae Range and from 243–518 m (797–1,700 ft) in the windward Ko'olau Range. Mesic forests receive 1,520–2,030 mm (60–80 in) of annual rainfall and experience a seasonal drought period. These habitats support a variety of plant species, and are dominated in the canopy by species such as koa (*Acacia koa*), 'ōhi'a (*Metrosideros polymorpha*), lama (*Diospyros sandwicensis*), and olopuā (*Nestegis sandwicensis*) trees. Wet forests represent the highest-elevation vegetative communities on O'ahu, and are found at elevations above 518 m (1,700 ft) in the windward Ko'olau Range and at greater than 792 m (2,600 ft; i.e. summit areas) in the leeward Wai'anae Range. Wet forests receive over 2,030 mm (80 in) of annual rainfall with no significant dry period, and are dominated by 'ōhi'a trees.



## HABITAT VULNERABILITY

Mesic and wet forests on O'ahu are sensitive to climatic changes that alter water availability, which affects forest distribution, productivity, and vegetative composition. Disturbance events undermine the health and survival of native species and can damage large areas of forest, potentially allowing invasive plants to become established. Invasive species can alter ecosystem processes, compete with native taxa, and contribute to mortality and impaired recruitment in native species. Many non-climate stressors also contribute to the reduction of native pollinator populations, which can impair native forest regeneration. Significant forest area has been lost and remaining forest areas are highly invaded. Mesic and wet forests have low public value and societal support, though strong support for managements exists in some constituency groups and many forest areas are protected.

PROJECTED FUTURE CHANGES	POTENTIAL IMPACTS ON MESIC & WET FOREST HABITATS
Reduced precipitation and soil moisture and increased drought risk	<ul style="list-style-type: none"> <li>• Increased transpiration and greater water stress in native vegetation</li> <li>• Decreased survival &amp; recruitment</li> <li>• Increased vulnerability to some invasive species</li> </ul>
Increased frequency and strength of tropical storms/hurricanes	<ul style="list-style-type: none"> <li>• Major forest damage (especially in mesic forests), resetting succession</li> <li>• Increased colonization opportunities for invasive plants in canopy openings</li> </ul>
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"> <li>• Increased evapotranspiration and associated water loss in plants</li> <li>• Upslope expansion of mosquitos that carry avian malaria</li> </ul>
Increased wildfire	<ul style="list-style-type: none"> <li>• Plant mortality and reduced forest recovery where fires are more frequent, especially in the presence of invasive species</li> <li>• Increased erosion</li> </ul>
Changes in wind and circulation	<ul style="list-style-type: none"> <li>• Decreased high-elevation rainfall, increasing plant water stress</li> </ul>
Increased disease and insects	<ul style="list-style-type: none"> <li>• Damage and mortality within native species, especially those already stressed by drought</li> </ul>

**Wet forest**

**Mesic forest**

**Drivers of Ecosystem Service Vulnerability**

- **Climatic factors and disturbance regimes:** Precipitation, soil moisture, drought, tropical storms/hurricanes, air temperature, wildfire, wind/circulation, disease, insects
- **Non-climate factors:** Invasive species (ungulates, mammalian predators, trees/shrubs, social insects, flammable grasses, birds), recreation
- **Other sensitivities:** Loss of pollinators/dispersers

## ADAPTIVE CAPACITY

**Factors that enhance adaptive capacity:**

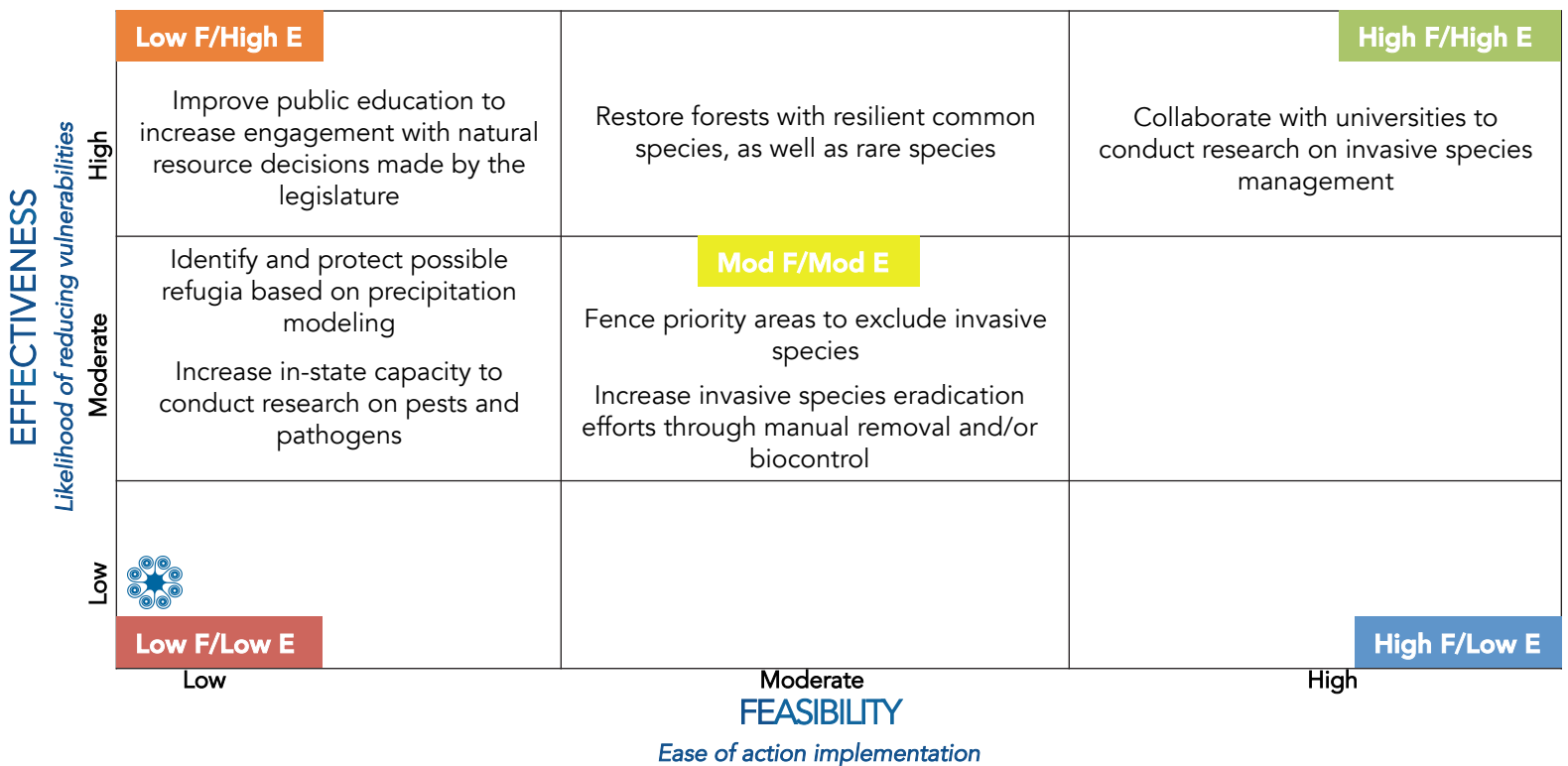
- + High-elevation wet forests are less degraded due to their isolated location
- + Dedicated constituency groups (e.g., watershed partnerships) support forest conservation and management
- + Some forest areas are protected, which may buffer climate impacts

**Factors that undermine adaptive capacity:**

- Restricted forest distribution, with greater degradation at low-elevations
- Fragmentation and reduced vegetation abundance limits seed production, dispersal, and recovery from disturbance
- Low public value and little funding for habitat protection and restoration

# ADAPTATION STRATEGIES FOR MESIC & WET FORESTS

Types of Adaptation Approaches	Adaptation Strategy	Specific Action
<b>Resistance:</b> Prevent climate change from affecting a resource. <i>Near-term approach</i>	Manage invasive species	<ul style="list-style-type: none"> <li>Increase invasive species eradication efforts through manual removal and/or biocontrol of ungulates, predators, and plants with a high rate of spread</li> <li>Fence priority areas to exclude invasive species within intact forest</li> </ul>
<b>Resilience:</b> Help resources weather climate change by avoiding the effects of or recovering from changes <i>Near- to mid-term approach</i>	Restore native mesic and wet forest habitat	<ul style="list-style-type: none"> <li>Restore forests with resilient common species, as well as rare species</li> </ul>
<b>Response:</b> 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"> <li>Identify and protect possible refugia based on precipitation modeling</li> </ul>
<b>Knowledge:</b> Gather information about climate impacts and/or management effectiveness in addressing climate challenges <i>Near- to long-term approach</i>	Increase capacity for mesic/wet forest restoration	<ul style="list-style-type: none"> <li>Increase in-state capacity to conduct research on pests and pathogens</li> </ul>
<b>Collaboration:</b> Coordinate efforts and capacity across landscapes and agencies <i>Near- to long-term approach</i>	Increase outreach and education to support forest restoration and management	<ul style="list-style-type: none"> <li>Improve public education to increase engagement with natural resource decisions made by the legislature</li> </ul>



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](http://www.bit.ly/HawaiiClimate).

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