Mesic & Wet Forests

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

HABITAT DESCRIPTION

Mesic and wet forest habitats are typically found on windward lowland areas and montane slopes up to elevations of 2,194 m (7,200 ft). These mesic/wet bands are created in areas that lie at or below the mean height of the trade wind inversion, and the wettest areas receive up to 7,620 mm (300 in) of rainfall per year. Mesic and wet forest habitat types range from mesic forests at mid-elevations to tropical montane cloud forests at the highest elevations, and are typically dominated by 'ōhi'a lehua (*Metrosideros polymorpha*) and koa (*Acacia koa*) trees with dense understories composed of shrubs, ferns, and sedges. Mesic and wet forest habitats can be found on east Maui and on the upland, windward slopes of west Maui. On Lāna'i, mesic forests are distributed on the windward slopes and extend down to the ocean.

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HABITAT VULNERABILITY

Mesic and wet forests are sensitive to factors that alter the strong rainfall and moisture gradients that drive habitat distribution and species composition. Disturbance events (e.g., disease, insects) can damage large areas of forest, potentially allowing invasive plants to become established in disturbed areas. Invasive species are the primary non-climate stressor, and impact forests by altering native species composition, distribution, survival, and reproduction/recruitment, contributing to the rapid decline of many native species. Although high-elevation wet forests remain relatively intact, lowland areas and mesic forests have been fragmented and degraded. Management and restoration may be successful at alleviating some impacts, but public and societal support for mesic and wet forest habitats is low.

PROJECTED FUTURE CHANGES	POTENTIAL IMPACTS ON MESIC & WET FOREST HABITATS
Increased **drought** risk	• Potential shifts in forest distribution along the tree line • Increased shrub mortality and shifts in plant dominance towards herbaceous species
Reduced **precipitation** and **soil moisture** *Except on windward slopes*	• Increased evaporative demand and greater water stress, especially along the tree line
Increased **air temperatures** *+2.0°C (3.6°F) to +3.5°C (6.3°F), with greater increases at high elevations*	• Range expansion for invasive species and/or the establishment of new species • Upslope expansion of mosquitos that carry avian malaria
Increased frequency and strength of **tropical storms/ hurricanes**	• Forest damage and colonization of invasive plants in canopy openings • Possible extirpation of highly localized/endemic populations or species
Increased **disease**	• Expanded distribution of diseases that impact native species, including trees (e.g., koa wilt) and endemic forest birds (e.g., avian malaria)
Increased **insect outbreaks**	• Damage and mortality of native species, especially those already stressed by drought; may impact large areas of forest

Drivers of Habitat Vulnerability

- **Climatic factors and disturbance regimes:** Drought, precipitation, soil moisture, air temperature, tropical storms/ hurricanes, disease, insects
- **Non-climate factors:** Invasive species (ungulates, trees/shrubs, pathogens/ parasites, mammalian predators, flammable grasses)

ADAPTIVE CAPACITY

Factors that enhance adaptive capacity:

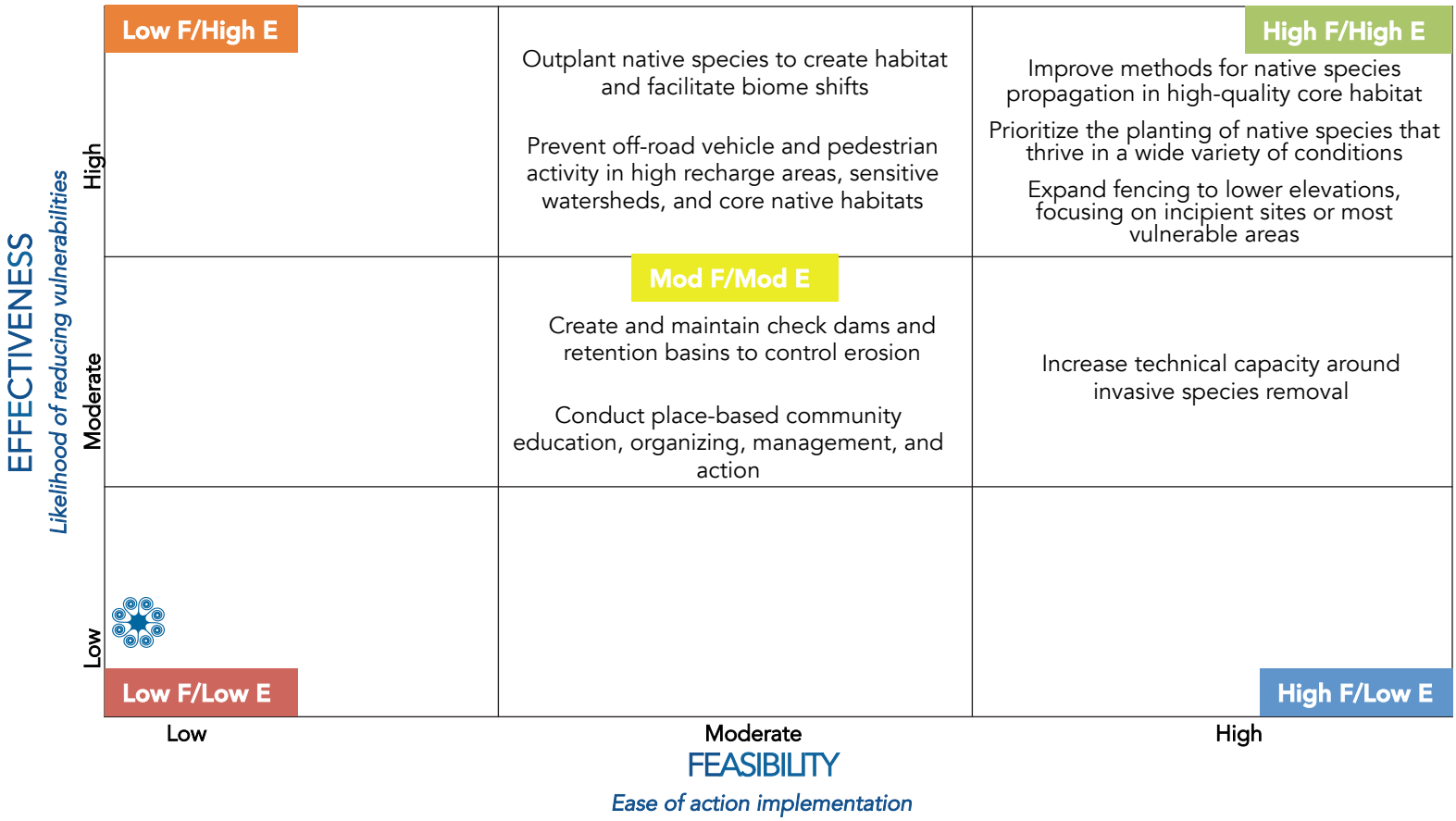
+ One of the largest areas of intact cloud forest on the Hawaiian Islands is in East Maui
+ Rapid recovery from stressors and disturbances; some native species are adapted to wildfire
+ Very high species diversity and endemism; still dominated by native species in most areas
+ Management may successfully protect climate refugia and manage non-climate stressors, alleviating the impacts of climate change

Factors that undermine adaptive capacity:

– Increased human use pressure in lowland forests; fragmentation can prevent species dispersal
– Drier mesic forests may be unable to recover from disturbance or degradation
– Low public value due to development pressure and conversion to agriculture
– Little funding available for habitat protection and restoration

ADAPTATION STRATEGIES FOR MESIC & WET FORESTS

Types of Adaptation Approaches	Adaptation Strategy	Specific Action
Resistance: Prevent climate change from affecting a resource. *Near-term approach*	Manage invasive species	• Expand fencing to lower elevations, focusing on incipient sites or most vulnerable areas throughout the forest
	Improve fire prevention	• Prevent off-road vehicle and pedestrian activity in high recharge areas, sensitive watersheds, and core native habitats
Resilience: Help resources weather climate change by avoiding the effects of or recovering from changes *Near- to mid-term approach*	Maintain intact, native-dominated ecosystems	• Outplant native species to create habitat and facilitate biome shifts
	Maintain and restore water quality	• Create and maintain check dams and retention basins to control erosion
Response: Intentionally accommodate change and adaptively respond to variable conditions *Long-term approach*	Facilitate transition of species into new areas as climate regimes shift	• Prioritize the planting of native species that thrive in a wide variety of conditions (e.g., generalists, resilient native/endemic species)
Knowledge: Gather information about climate impacts and/or management effectiveness in addressing climate challenges *Near- to long-term approach*	Develop more efficient tools for habitat restoration and invasive species control	• Increase technical capacity around invasive species removal (e.g., herbicide delivery) • Improve methods for native species propagation (all taxa) in high-quality core habitat
Collaboration: Coordinate efforts and capacity across landscapes and agencies *Near- to long-term approach*	Increase direct community restoration	• Conduct place-based community education, organizing, management, and action focused on habitat restoration, cultural practices, and climate change impacts



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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