Cultural Knowledge & Heritage Values

Climate Change Adaptation Summary for O'ahu

An Important Note About this Document: *This document represents an initial effort to identify adaptation actions for cultural knowledge and heritage values on O'ahu based on stakeholder input and existing information. Specifically, the information presented below comprises stakeholder input,[1] peer-review comments and revisions, and relevant examples from the literature or other similar efforts. The aim of this document is to expand understanding of possible adaptation actions for O'ahu cultural knowledge and heritage values in response to climate change.*

Ecosystem Service Vulnerability

Cultural knowledge and heritage values on O'ahu were evaluated as having high vulnerability to climate change due to high sensitivity to climate and non-climate stressors, high exposure to projected future climate changes, and low-moderate adaptive capacity. This ecosystem service is vulnerable to climatic changes that impact the health and integrity of ecosystems and/or native species, as well as to impacts that damage or destroy valued cultural assets and heritage sites. These include changes in precipitation, air and water temperatures, sea level rise, ocean pH and sea surface temperature, and wind/circulation patterns. Disturbance events, such as wildfire, floods, insect outbreaks, and disease, can affect large areas and cause extensive damage or loss of living things and landscapes of cultural importance. Many non-climate stressors are linked to increasing human populations and associated impacts of changes in land use and the overuse of natural resources (e.g., residential and commercial development, pollution and poisons, water diversions, recreation), which have fragmented and degraded natural habitats, exacerbating the negative effects of climate change. The introduction and establishment of invasive species, including plants, wildlife, insects, fish, and pathogens/parasites, have had a large impact on cultural knowledge and heritage by altering ecosystem functions and driving the loss of native species and habitats. Native Hawaiian knowledge and heritage is still affected by colonialism, and these values receive relatively little public and societal recognition and support. However, the importance of cultural knowledge, as well as the adaptability of historical cultural practices, is increasingly being recognized and incorporated into natural resource management.

Adaptation Strategies and Actions

Table 1 presents a summary of possible adaptation strategies and actions for O'ahu cultural knowledge and heritage ecosystem services, and consists of stakeholder input during an adaptation workshop as well as additional options from the literature or other similar efforts. Stakeholders identified ways in which current management actions could be modified to reduce ecosystem service vulnerabilities as well as future management actions that are not currently implemented but could be considered for future implementation.

Resilient management requires implementing a range of adaptation options within these different categories in order to achieve short-, mid-, and long-term resilience. These adaptation strategies and actions can generally be grouped according to one of five categories:

1. **Resistance**. These strategies can help to prevent the effects of climate change from reaching or affecting a resource.
2. **Resilience**. These strategies can help a resource withstand the impacts of climate change by avoiding the effects of or recovering from changes.

[1] This information was gathered during a climate adaptation planning workshop in April 2017 (http://www.ecoadapt.org/workshops/oahuadaptationworkshop). 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.

3. **Response**. These strategies intentionally accommodate change and/or enable resources to adaptively respond to changing and new conditions.
4. **Knowledge**. These strategies are aimed at gathering more information about climatic changes, impacts, or the effectiveness of management actions in addressing climate change.
5. **Collaboration**. These strategies may help coordinate efforts and/or capacity across landscapes and agencies.

Table 1. Summary of possible adaptation options for O'ahu cultural knowledge and heritage ecosystem services. All strategies and actions were identified by O'ahu workshop participants unless noted otherwise. Adaptation approaches are classified by implementation timeframes (*Near-term*: 0-5 years; *Mid-term*: 5-20 years; *Long-term*: >20 years).

Adaptation Approach	Adaptation Strategy	Specific Adaptation Actions
Resistance *Near-term approach*	Protect natural cultural resources and native ecosystems	• Work with cultural groups to identify the best way to protect cultural sites (e.g., to use or not use signs to mark places)
	Improve fire prevention and response	• Increase funding for support of fire response agencies and Community Wildland Protection Plans[2]
	Manage invasive species	• Improve biosecurity controls to prevent the introduction of invasive insects, pathogens, plants, and animals
	Reduce non-climate stressors that affect water quality	• Practice strategic watershed fence placement from mauka to makai to reduce pollutant and sediment runoff
Resilience *Near- to mid-term approach*	Perpetuate cultural knowledge, practices, and sites (e.g., landscapes, traditions, and values)	• Maintain water availability for cultural groups to sustain traditional practices (e.g., lo'i and spring use)
	Reduce non-climate stressors that affect water quality	• Protect seagrasses and corals that may help buffer the effects of ocean acidification[3]
	Encourage local participation in preserving cultural resources	• Streamline permitting system for practitioners and partners (e.g., one permit for a fishpond system instead of several)
	Integrate cultural knowledge into resource management	• Consider cultural values, resources, and sites in responding to extreme weather events, climate change, and storms
Response *Long-term approach*	Plan for managed retreat of coastal habitats	• Limit development in inland/upland areas where coastal habitats may migrate[4] • Limit development in most vulnerable sites[2] • Acquire land for mauka migration in anticipation of sea level rise, increasing temperatures, and precipitation changes[2]
Knowledge *Near- to long-*	Identify community concerns about climate change and	• Work with communities and cultural practitioners to identify the cultural resources most at risk

[2] Developed by Maui adaptation workshop participants in April 2017.
[3] Gregg, R.M., A. Score, D. Pietri, and L. Hansen. 2016. The State of Climate Adaptation in U.S. Marine Fisheries Management. EcoAdapt, Bainbridge Island, WA.
[4] Developed by Kaua'i adaptation workshop participants in June 2017.

Adaptation Approach	Adaptation Strategy	Specific Adaptation Actions
term approach	variability to help direct research	
	Increase collaboration between researchers and the community	• Foster research from Native Hawaiian communities and knowledge systems to increase access to traditional ecological knowledge
	Incorporate cultural concerns and community relations into climate adaptation projects	• Research community priorities to avoid adversely affecting cultural resources • Ensure projects are consistent with cultural resource protection
Collaboration *Near- to long-term approach*	Increase collaboration between researchers and the community	• Require researchers outside the Native Hawaiian community to take cultural components into account (e.g. within permitting processes) • Provide background cultural material to support research in order to avoid putting the education burden on communities • Incorporate community engagement protocols into funding requirements and research permits and they are sustained throughout the lifetime of the project
	Integrate cultural knowledge into resource management	• Work with cultural practitioners during development of management plans
	Refine communication strategies to increase buy-in and engagement	• Incorporate cultural and/or uniquely Hawaiian components into climate change communication products (e.g., cultural voyaging, lei) • Identify and cultivate community leaders to help share messages about cultural resilience and adaptation • Develop materials and methods to communicate climate impacts in empowering ways (e.g., promote collaborative conversations vs. outsiders coming in)
	Increase local food security	• Create rating system for public to emphasize and promote local foods grown through Native Hawaiian practices
	Encourage local participation in preserving cultural resources	• Identify partners that could provide additional space for cultural activities and resources (e.g., schools, botanical gardens, unused lots) • Identify community roadblocks for local conservation/preservation and cultural resources most at risk • Increase availability of cultural education and apprenticeships

Table 2 identifies key O‘ahu cultural knowledge and heritage ecosystem service vulnerabilities that may be reduced and/or addressed by various adaptation actions. Linking vulnerabilities to adaptation options can help managers decide which actions to implement and aid prioritization based on multiple factors (e.g., habitat type, observed or projected changes, ecosystem service). However, when selecting adaptation actions for

implementation, it is also important to consider secondary effects on other resources, both positive and negative. For example, fencing may benefit native forest ecosystems by limiting ungulate access and activity, but may increase ungulate stress on other habitats. For more information about O‘ahu adaptation strategies and actions developed by workshop participants, many of which are relevant to resilient management of cultural knowledge and heritage ecosystem services, including where and how to implement adaptation actions, implementation timeframe, collaboration and capacity required, and secondary effects on other resources (both positive and negative), please see the report *Hawaiian Islands Climate Vulnerability and Adaptation Synthesis*.

Table 2. Key vulnerabilities of O'ahu cultural knowledge and heritage ecosystem services linked to specific adaptation actions and management activities (linkages are based on expert opinion); implementation of adaptation actions (central column) may help to directly reduce and/or address the impacts of identified climate and non-climate stressors and disturbance regimes (right columns). Actions highlighted in **red** represent adaptation strategies that enhance resistance, those highlighted in **orange** promote resilience, and those highlighted in **green** facilitate response. Adaptation actions aimed at increasing knowledge and collaboration are not included in this table as they address vulnerability indirectly. Adaptation actions listed in this table include those identified by stakeholders, in the scientific literature, and in other similar efforts.

Management Activity	Adaptation Actions	Climate Stressors						Disturbance Regimes			Non-Climate Stressors				
		↑ Air & stream temperatures	Δ Precipitation (amount/timing); Δ Wind and circulation	Δ Extreme precipitation events	Δ Streamflow	↑ Sea level rise; ↑ Coastal flooding	↑ Ocean acidification; ↑ Sea surface temperature	↑ Wildfire	Δ Riverine flooding	↑ Insects & disease	Agriculture & aquaculture; Water diversions; Groundwater development	Pollution & poisons	Invasive species	Residential & commercial development; Population growth; Energy production	Roads/highways/trails; Recreation
Habitat Management Activities	Work with cultural groups to identify the best way to protect cultural sites (e.g., to use or not use signs to mark places)													✔	✔
	Protect seagrasses and corals that may help buffer the effects of ocean acidification						✔								
	Consider cultural values, resources, and sites in responding to extreme weather events, climate change, and storms			✔		✔			✔						
Water Resource Management Activities	Practice strategic watershed fence placement from mauka to makai to reduce pollutant and sediment runoff			✔			✔		✔			✔			
	Maintain water availability for cultural groups to sustain traditional practices (e.g., lo'i and spring use)		✔		✔						✔				
Policy & Regulatory Activities	Improve biosecurity controls to prevent the introduction of invasive insects, pathogens, plants, and animals									✔			✔		
	Streamline permitting system for practitioners and partners (e.g., one permit for a fishpond system instead of several)										✔				
Land Use & Project Planning Activities	Increase funding for support of fire response agencies and Community Wildland Protection Plans							✔							
	Limit development in inland/upland areas where coastal habitats may migrate					✔									
	Limit development in most vulnerable sites	✔	✔			✔									
	Acquire land for mauka migration in anticipation of sea level rise, increasing temperatures, and precipitation changes	✔	✔			✔									

In addition to directly reducing vulnerabilities (Table 2), some adaptation actions may indirectly address vulnerabilities. For example, increasing the availability of cultural education and apprenticeship will create a larger population of practitioners that understand the potential impacts of climate change and have the skills to manage cultural resources under changing climate conditions.

Two other important considerations when selecting adaptation actions for implementation include feasibility (action capable of being implemented) and effectiveness (action reduces vulnerability; Figure 1). An adaptation action with high feasibility has no obvious barriers and a high likelihood of implementation, whereas an action with low feasibility has obvious and/or significant barriers to implementation that may be difficult to overcome. An adaptation action with high effectiveness is very likely to reduce associated vulnerabilities (listed in Table 2) and may benefit additional management goals or resources, whereas an action with low effectiveness is unlikely to reduce vulnerability and may have negative impacts on other resources.

Feasibility of Implementing the Action

- *High*: There are no obvious barriers and it has a high likelihood of being implemented
- *Moderate*: It may be possible to implement the action, although there may be challenges or barriers
- *Low*: There are obvious and/or significant barriers to implementation that may be difficult to overcome

Action Effectiveness at Reducing Vulnerabilities

- *High*: Action is very likely to reduce vulnerability and may benefit additional goals or habitats
- *Moderate*: Action has moderate potential to reduce vulnerability, with some limits to effectiveness
- *Low*: Action is unlikely to reduce vulnerability

Figure 1. Description of action feasibility and effectiveness rankings.

Figure 2 plots adaptation actions listed in Table 1 according to feasibility and effectiveness (rankings described in Figure 1). Figure 2 can help managers prioritize actions for implementation (e.g., actions with high feasibility and high effectiveness), better target management efforts toward specific challenges (e.g., actions with low or moderate feasibility but high effectiveness), and/or evaluate whether to proceed with implementation (e.g., actions with high feasibility but low effectiveness). For the latter two purposes, managers may consider the following questions:

- **Low or Moderate Feasibility/High Effectiveness Actions**: What steps can be taken to increase the likelihood of this action being implemented in the future?
    - *Example*: Would improving public outreach and education or enhancing public/private collaboration facilitate increased management access and activity on private lands (e.g., to remove invasive species)?
- **High Feasibility/Low or Moderate Effectiveness Actions**: Does this action still make sense given projected climate changes and impacts?
    - *Example*: If conditions are projected to become drier, should groundwater pumping still continue to support lowland wetland hydrology?

Alternatively, there may be some actions that do not reduce vulnerability directly but could provide important information, tools, or support to address vulnerability down the line. For example, actions aimed at increasing knowledge through monitoring or modeling could provide key information for future restoration activities (e.g., creating detailed species genetic profiles to select genetically and ecologically suitable plant species for future conditions). Managers may want to weigh the costs and benefits of implementing actions with the timeframe required to reduce vulnerability directly. Additionally, actions focused on coordination and collaboration may not directly address vulnerabilities, but these remain important steps toward better planning and management.

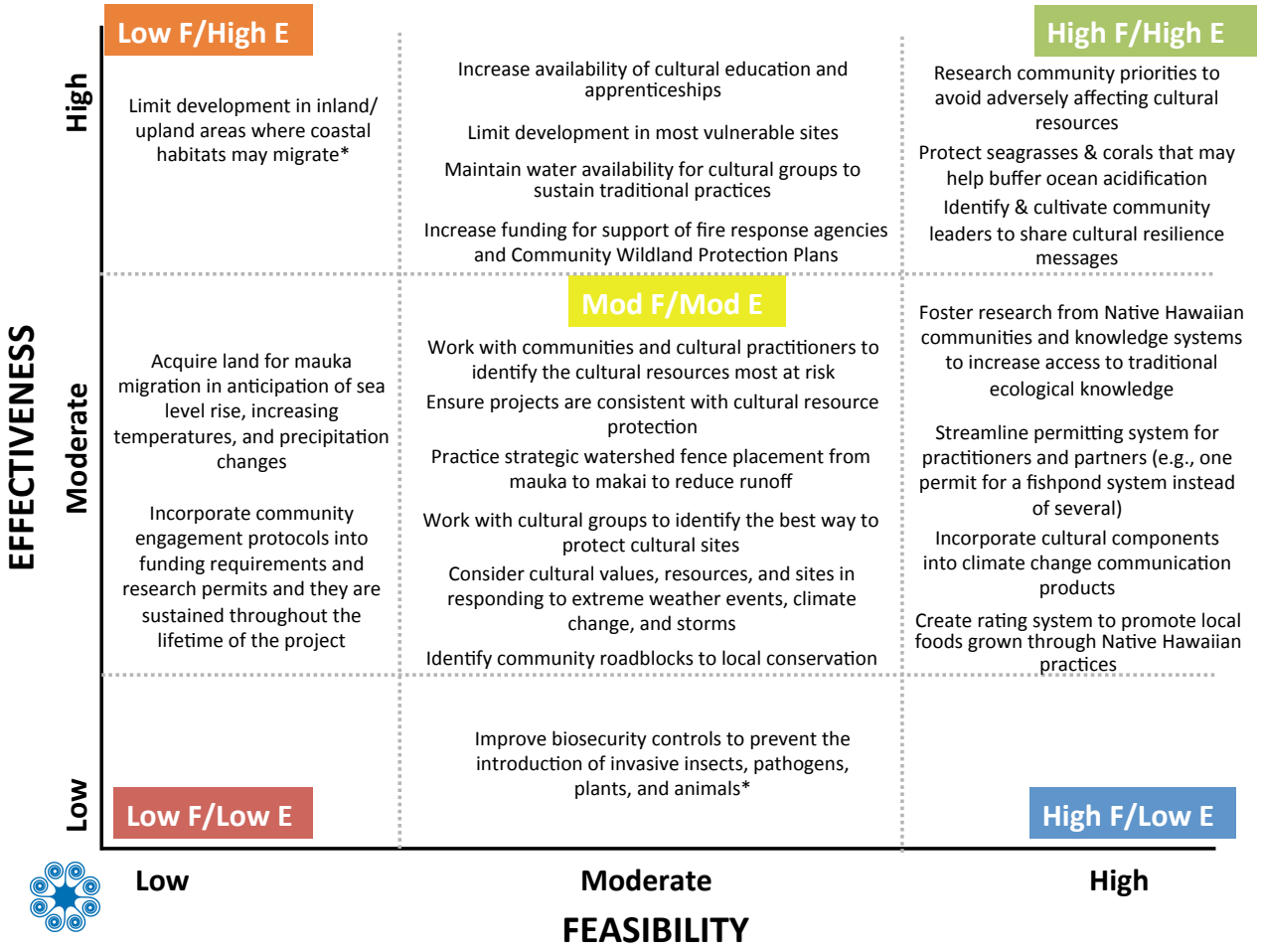

Figure 2. O‘ahu cultural knowledge and heritage ecosystem service adaptation actions plotted according to implementation feasibility (action capable of being implemented) and effectiveness (action reduces vulnerability). Those actions having high feasibility and effectiveness appear in the upper right corner and those actions having low feasibility and effectiveness appear in the bottom left corner. An asterisk (*) denotes adaptation actions evaluated for feasibility and effectiveness by workshop participants. All other adaptation action evaluations are based on expert opinion.

Lastly, it is important to consider long-term consequences of implementing adaptation actions. One way to evaluate this is to consider how easy it would be to reverse a management action once it has been implemented in case of unintended consequences. When considering action reversibility, managers should consider cost, personnel time, overall time required to reverse an action, and other relevant factors. For example, it would likely be easy to reverse an action focused on altered outplanting timing; outplanting timing could simply be changed to a more favorable time. Alternatively, it would likely be hard to reverse the successful introduction of a new biocontrol agent, requiring significant personnel time and funding. Generally, actions involving infrastructure installation, policy or legislative change, or new species introductions may be moderately difficult or hard to reverse.

Table 3 lists adaptation actions identified in Table 1 according to ease of action reversibility, as well as feasibility and effectiveness. This table can help managers evaluate whether to proceed with implementation (e.g., easily reversible actions) and/or identify actions that may need more research, small-scale testing, careful planning and implementation, and/or heightened adaptive management (e.g., moderately difficult or hard to reverse actions).

Table 3. O‘ahu cultural knowledge and heritage ecosystem service adaptation actions listed according to ease of action reversibility, as well as feasibility and effectiveness. Actions that have high feasibility/effectiveness and are easy to reverse appear at the top of the list, and actions that have low feasibility/effectiveness and are hard to reverse appear at the bottom of the list. All adaptation action evaluations are based on workshop participant and expert opinion.

Adaptation Action	Feasibility	Effectiveness	Reversibility
Research community priorities to avoid adversely affecting cultural resources	High	High	Easy
Identify and cultivate community leaders to help share messages about cultural resilience and adaptation	High	High	Moderate
Protect seagrasses and corals that may help buffer the effects of ocean acidification	High	High	Moderate
Develop materials and methods to communicate climate impacts in empowering ways (e.g., promote collaborative conversations vs. outsiders coming in)	High	High	Moderate
Create rating system for public to emphasize and promote local foods grown through Native Hawaiian practices	High	Moderate	Easy
Provide background cultural material to support research in order to avoid putting the education burden on communities	High	Moderate	Easy
Work with cultural practitioners during development of management plans	High	Moderate	Easy
Incorporate cultural and/or uniquely Hawaiian components into climate change communication products (e.g., cultural voyaging, lei)	High	Moderate	Easy
Streamline permitting system for practitioners and partners (e.g., one permit for a fishpond system instead of several)	High	Moderate	Moderate
Foster research from Native Hawaiian communities and knowledge systems to increase access to traditional ecological knowledge	High	Moderate	Moderate
Increase availability of cultural education and apprenticeships	Moderate	High	Easy
Increase funding for support of fire response agencies and Community Wildland Protection Plans	Moderate	High	Moderate
Maintain water availability for cultural groups to sustain traditional practices (e.g., lo‘i and spring use)	Moderate	High	Moderate
Limit development in most vulnerable sites	Moderate	High	Hard
Identify partners that could provide additional space for cultural activities and resources (e.g., schools, botanical gardens, unused lots)	Moderate	High	Moderate
Ensure projects are consistent with cultural resource protection	Moderate	Moderate	Easy
Consider cultural values, resources, and sites in responding to extreme weather events, climate change, and storms	Moderate	Moderate	Easy
Require researchers outside the Native Hawaiian community to take cultural components into account (e.g. within permitting processes)	Moderate	Moderate	Easy
Practice strategic watershed fence placement from mauka	Moderate	Moderate	Moderate

to makai to reduce pollutant and sediment runoff			
Work with cultural groups to identify the best way to protect cultural sites (e.g., to use or not use signs to mark places)	Moderate	Moderate	Moderate
Work with communities and cultural practitioners to identify the cultural resources most at risk	Moderate	Moderate	Moderate
Identify community roadblocks for local conservation/preservation and cultural resources most at risk	Moderate	Moderate	Moderate
Improve biosecurity controls to prevent the introduction of invasive insects, pathogens, plants, and animals	Moderate	Low	Easy
Limit development in inland/upland areas where coastal habitats may migrate	Low	High	Moderate
Incorporate community engagement protocols into funding requirements and research permits and ensure they are sustained throughout the lifetime of the project	Low	Moderate	Easy
Acquire land for mauka migration in anticipation of sea level rise, increasing temperatures, and precipitation changes	Low	Moderate	Hard

This document presents a range of adaptation options available for O‘ahu cultural knowledge and heritage ecosystem services. When applying adaptation principles in existing management frameworks, general best practices include:

- ✓ Utilizing a range of adaptation categories to promote short-, mid-, and long-term resilience.
- ✓ Thinking critically about which climate vulnerabilities an action can directly address versus those it may address indirectly.
- ✓ Identifying where opportunities overlap (e.g., actions that address multiple vulnerabilities or benefit multiple resources), and being cognizant of actions that could create detriments to other resources.
- ✓ Prioritizing actions for implementation based on 1) how effective an action will be in reducing identified vulnerabilities; 2) how feasible implementing the action will be, and; 3) how easy it would be to reverse an action in case of unintended consequences.

Recommended Citation

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