**Factors that enhance adaptive capacity:**

- Estuarine species typically tolerant of variable conditions
- Several habitat areas are protected and actively managed, which may help buffer impacts
- Provide a variety of ecosystem services
- O‘ahu has a high number of estuarine habitats and habitat diversity improves with restoration efforts

**Factors that undermine adaptive capacity:**

- Many estuaries are dominated by invasive species or degraded by agricultural and urban runoff
- Limited capacity to accrete sediment and keep pace with sea level rise due to small tidal ranges
- Support many rare, endemic, and endangered species, which may be more vulnerable to climate impacts
## ADAPTATION STRATEGIES FOR ESTUARINE HABITATS

<table>
<thead>
<tr>
<th>Types of Adaptation Approaches</th>
<th>Adaptation Strategy</th>
<th>Specific Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resistance</strong>: Prevent climate change from affecting a resource. <em>Near-term approach</em></td>
<td>Restore and conserve native shoreline and estuary habitat</td>
<td>• Remove mangroves and other invasive vegetation</td>
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<tr>
<td></td>
<td>Reduce non-climate stressors that affect water quality</td>
<td>• Reduce pollutant and sediment runoff (e.g., revegetate slopes with native plants, reduce acreage of fallow agricultural land)</td>
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<tr>
<td><strong>Resilience</strong>: Help resources weather climate change by avoiding the effects of or recovering from changes <em>Near- to mid-term approach</em></td>
<td>Restore and conserve native shoreline and estuary habitat</td>
<td>• Restore native species</td>
</tr>
<tr>
<td><strong>Response</strong>: Intentionally accommodate change and adaptively respond to variable conditions <em>Long-term approach</em></td>
<td>Anticipate and facilitate habitat migration</td>
<td>• Acquire property with high future ecosystem value (e.g., less developed, less exposed/vulnerable sites) • Identify critical infrastructure that needs to be protected or relocated</td>
</tr>
<tr>
<td><strong>Knowledge</strong>: Gather information about climate impacts and/or management effectiveness in addressing climate challenges <em>Near- to long-term approach</em></td>
<td>Develop more efficient technologies/tools for habitat restoration and invasive species control</td>
<td>• Develop alternative removal technologies that the public can do themselves</td>
</tr>
<tr>
<td><strong>Collaboration</strong>: Coordinate efforts and capacity across landscapes and agencies <em>Near- to long-term approach</em></td>
<td>Develop more efficient technologies/tools for habitat restoration and invasive species control</td>
<td>• Enhance interagency coordination between groups working in the same landscape area</td>
</tr>
</tbody>
</table>

### EFFECTIVENESS

- **Low F/High E**: Acquire property with high future ecosystem value
  - Identify critical infrastructure that needs to be protected or relocated
  - Reduce pollutant and sediment runoff
- **Mod F/Mod E**: Remove mangroves and other invasive vegetation
  - Restore native species
  - Develop alternative invasive removal technologies that the public can do themselves
  - Enhance interagency coordination between groups working in the same landscape area
- **High F/High E**: 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.

**Reynier WA, Hilberg LE, Gregg RM. 2018. Estuarine Habitats: Vulnerability and Adaptation Brief for O’ahu. EcoAdapt, Bainbridge Island, WA.**

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