Thinking Ahead:
Incorporating Climate Change into Aquatic Ecosystem Restoration Planning for the Ala Wai Watershed Project

Cindy Barger
U.S. Army Corps of Engineers
Honolulu District

August 5, 2011
NCER
Outline

- Ala Wai Watershed Project Background
- Hawaii Climate Change Issues
- Climate Change Strategies For Ecosystem Restoration
- Application of Strategies to the Ala Wai Watershed
Ala Wai Watershed

Population:
- 160,000 residents
- 71,000 visitors/day

Size:
- 19 square miles
- Highest Point: 3100ft

Economic Base:
- 8% Gross State Product – $3.6B
- 11% Civilian Jobs in State
- 12% State & County Tax Revenue
- 1,600 businesses
- 38 Schools and 2 Universities

Streams & Waterways:
- 3 Perennial Streams & 2 Canals
- 1 Marine Protected Area
- Base flow: 8,000 cfs
- Flood Duration: 40-50 min
Problems

Potential Flood Damage:
- 3,000 properties within 100 yr floodplain
- $311 million in damages

Aquatic Ecosystem Degradation:
- Degraded stream habitat
- Increased sediment & erosion
- Invasive species
- Loss of 2,000 acres of coastal wetlands
- Degraded coral habitat

Water Quality: Impaired
- Trash
- Pesticides
- Nutrients
Ala Wai Project Goals & Objectives

Improve the overall quality of the Ala Wai watershed, from the crest of the Ko’olau Mountains to the nearshore waters, with a focus on reducing flood hazards and restoring aquatic ecosystem function.

► Flood Risk Management
► Aquatic Ecosystem Restoration
► Water Quality Improvement
► Maximize Recreational Opportunities
► Water Supply Enhancement

- Sponsors: USACE, State of Hawaii Department of Land & Natural Resources (DLNR), City & County of Honolulu Environmental Services (ENV).
Ala Wai Watershed Project Schedule

MILESTONES

- Project Initiation – June 2003
  - Manoa Flood 2004
  - Amendment 2006

- Feasibility Scoping Meeting
  June 2011

- Alternatives Formulation
  Briefing Report – Fall 2012

- Draft Feasibility Report & EIS
  Winter 2013

- Final Feasibility / EIS – Fall 2013
Hawaii Climate Change Issues

- Sea Level Rise: 0.08-0.68m (0.5-1.4m in 2100)
- Amount of Rainfall: Decrease 5-10%
- Rainfall Frequency: 12% increase in heavy events, Decrease in light events
- Rainfall Intensity: 5% annual flood increase in intensity by 10-25%
Hawaii Climate Change Issues

- **Groundwater**: Decline in Groundwater Recharge
- **Coral Reefs**: 20% decrease due to bleaching and ocean acidification
- **Species Diversity**: Increase in Species Extinction (400 federally listed species)
- **Unique Tropical Habitats**: Decline due to very sensitive to changes in microclimates.
- **Native Birds**: Increase in Avian malaria, primary threat.
- **Invasive Species**: Expansion due to high tolerance for a wide range of climatic conditions

![Amakihi (J. Jeffrey)](image1) ![I’iwi (USFS)](image2) ![Akepa (AAAS)](image3)
Hawaii Climate Change Issues

- Population: Increase from Climate Change Refugees
- Infrastructure: Increase coastal retreat will increase pressure on utilities, resources, pollution, waste disposal and housing.
- Food Security: Decrease in subsistence farming and fishing and increased dependence on imports and decreasing food security.
- Tourism: Increased hazard to tourism facilities from coastal erosion
- Water Supply: 34% increase in demand on Oahu
Climate Change Strategies
Literature Review - Objective

- Identify methods to address climate change for watershed-based aquatic ecosystem restoration during the planning process.

Courtesy of hawaiipictures.com
Common Themes

- Understand the Local Impacts and Interactions.
- Acknowledge the Uncertainties.
- Let Go of the Past.
- Commit to the Long-Term
- Plan for Surprises – Adapt, Adapt, Adapt
- One Size Does Not Fit All
Understand Local Impacts & Interactions

- Not Just Temperature/Hydrology
- Impact changes to…
  - Growing seasons
  - Shifts in habitat
  - Water quality
  - Habitat connectivity
  - Species tolerance and adaptability
  - Human population impacts

Ala Wai Watershed Application:

- Expert panels help develop local scenarios
- Incorporating new information/research from Statewide
Acknowledge the Uncertainties

- Uncertainty in Present Day & Future Species Distributions.
- Model Multiple Scenarios.
- Developing a culture that rewards risk taking would enhance the speed of adaptation to climate change challenges. – B. Griffith, 2009.

Ala Wai Watershed Application

- Communicate Risk & Uncertainty of Management Measures
- Leaning on State of Hawaii CZM/Seagrant Climate Change Communication Initiatives
Let Go of the Past

- Stochastic Planning for Process and Function Needed.
  - Designing to Historic Conditions not possible.
  - Designing to Reference Sites may be too Static.

- Ecological restoration can be viewed as an attempt to shift ecosystem composition, structure, and function to within a range that is more desirable than current conditions. – M.A. Palmer. 2009

Ala Wai Watershed Application:
- Focus on replacing lost functions.
- Developed watershed limits flexibility for shifting habitats
Commit to the Long Term

- Monitoring time-frame in decades.
- Apply a scientific method with consistent standards.
- Monitoring for the full array of climate consideration.
- With the constantly changing conditions brought about by global climate change, the definition of ecosystem preservation must have a significantly enhanced conception of time dimension. - K. Frederick, et al. 1997.

Ala Wai Watershed Application
- No strong champion for long term monitoring.
- Facilitating potential collaboration with UH Center for Conservation Biology.
One Size Does Not Fit All

- Multiple Interactions need Multiple Approaches

- Strategies (P. Halpin 1997)
  - Redundancy
  - Habitat Diversity
  - Buffer Zone Flexibility
  - Landscape Connectivity
  - Habitat Maintenance
  - Adaptive Management

Ala Wai Watershed Application:
  - Multiple approaches for redundancy and connectivity proposed.
  - Diversity of habitat and buffer flexibility constrained by development
Plan For Surprises—
Adapt, Adapt, Adapt

- Experimental Field Testing.
- Flexibility in Design.
- Structural Solutions as a Last Resort - Inflexible.
- Consider Artificial Supplementation when Necessary.
- Integrate Scientific Research into Planning Process.
- Interdisciplinary Approaches Necessary.

Ala Wai Watershed Application:
- Phased construction to allow for adaptation.
- Altered watershed will require structural solutions.
- Engaging University to champion research.
TNC – Washington State Program

Lessons from Business

- **Component Redundancy**
  - Boeing – Multiple Engines
  - TNC – Multiple Similar Habitats

- **Functional Redundancy**
  - Microsoft – Several Options to Open a File
  - TNC – Several Species to Provide Same Function

- **Increased Connectivity**
  - Starbucks – Coffee at Every Corner
  - TNC – Functional Corridors
Mahalo!

Ala Wai Watershed Project

www.alawaiwatershed.com

Cindy S. Barger

U.S. Army Corps of Engineers

e-mail: Cindy.S.Barger@usace.army.mil

Photo Courtesy of Robert Barger