Nature-Based Solutions Workshop for Hazard Mitigation

American Samoa
August 25, 2021, via Zoom
Instructions
The Pacific Islands Regional Climate Assessment (PIRCA) and NBS in American Samoa

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Nature-Based Solutions Workshop
August 25, 2021

Photo: Valentine Vaeoso
The Pacific Islands Regional Climate Assessment (PIRCA)

- A collaborative umbrella organization of academics, nonprofits, local and national governments, NGOs, community organizations, and businesses
- Assesses and collects climate observations, trends, and projections from peer-reviewed, white, and grey literature
- Partners with local managers, practitioners, and experts to frame and prioritize climate impacts across key local sectors
  - 5 lead authors, 23 technical contributors
Key Issues for Policymakers

- Air Temperatures: more hot days and fewer cool nights
- Extreme rainfall and flooding
- Coral reef bleaching and loss
- Sea level rise
- Inequitable impacts on communities
- Threats to community health
- Freshwater supplies
- Ecosystem health and biodiversity
- Threats to infrastructure
Samoan Translation of Key Issues

Suiga le Tau i Amerika Sāmoa: Faalio & Mau Ililoilona va Veaga Autu
Ripoti mo le Ilililago ou le Tau i le Ilililago ou Motu ou le Pasefika (PIRCIA) 2021

Manatu Autu mo Taatia ma a Faia Ailoa

Suiga le vavala le a a a a - Ta to foapape na vea, na ta foapape na pe a malo nei 'Amerika Sāmoa. E foapape na vea a to foa na le faaifaa ma na le mo'efo a le matamata a na a lea le no le vavala e le a.<

Suiga le Ilililago ou le Tau i le Ilililago ou Motu ou le Pasefika (PIRCIA) 2021
What are the risks of extreme weather and climate change in key sectors?

- If you are a water resources or utilities manager
- If you work in public health or disaster management
- If you are a coastal infrastructure decision-maker
- If you are in fisheries or manage ocean resources
- If you are in agroforestry or farming
- If you are in recreation or tourism
- If you manage ecosystems and biodiversity
- If you are in finance or economic development
- If you are a cultural or historical resources steward
- If you are an educator
FEMA BRIC Community Lifelines

- Food, Water, Shelter - Food, Water, Shelter, Agriculture
- Health and Medical - Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- Energy - Power Grid, Fuel
- Communications - Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- Transportation - Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- Hazardous Material - Facilities, HAZMAT, Pollutants, Contaminants

- The FEMA BRIC program emphasizes projects that address community lifeline functions
- These lifelines intersect with climate impacts outlined in different PIRCA sectors
- Combine BRIC lifelines, PIRCA climate impacts, and NBS for a triple threat project
Water Resources & Utilities

IMPACT
- Prepare for increased pollution in ground and surface water
- Monitor groundwater wells that are already salty
- Identify & harden water, wastewater, electrical, and other infrastructure vulnerable to sea level rise or storm damage

NBS
- Rain gardens, green roofs, stormwater retention wetlands
- Directed recharge areas
- Stream restoration

Taking water-quality samples from high level springs (Photo by Chris Shuler)
Public Health & Disaster Management

IMPACT

• Prepare for more frequent extreme heat events and illness
• Expect more frequent freshwater contamination and floods
• Monitor vector-borne diseases

NBS

• Increase tree cover/shade
• Stormwater retention and treatment wetlands
• Decrease impermeable areas with standing water

In 2019, Coconut Point, Nu‘uuli homes were flooded by a combination of a King Tide event with wind and ocean swell. (Photo by Kelley Anderson Tagarino)
Coastal Infrastructure

IMPACT

- More frequent coastal flooding and increased erosion
- More intense tropical cyclones and storm surge – reefs already protect over $46.5 million in infrastructure in American Samoa

NBS

- Prioritize reef conservation
- Facilitate mangrove restoration
- Stream restoration, vegetative buffers

Flooding in Leloaloa impacts transportation, safety, and health. (Photo by KVZK-TV)
Fisheries & Ocean Resources

IMPACT

• Increased frequency of coral bleaching
• Reduced reef and open-ocean fish catch

NBS

• Prioritize reef and ocean conservation and management
• Locate and farm local heat-resilient coral populations
• Reduce land-based pollution

Coral reefs in Tafuna experienced bleaching in 2020. (Photo by Valentine Vaeoso)
Agroforestry & Farming

IMPACT
- Increased food insecurity
- More stress on some crops in some locations (flood, heat, drought, disease, pests)
- Saltwater intrusion negatively impacting swamp taro

NBS
- Identify salt-tolerant crop varieties
- Increase local agroforestry and crop production
- Integrate traditional ecological knowledge and management

Sea level rise and inundation threaten crops in low lying areas. (Photo by Valentine Vaeoso)
Take home messages

- Climate change is already affecting diverse sectors and communities across American Samoa, and will continue to do so.
- Nature-based solutions to impacts from climate change can be combined with hazard planning.
- There are available resources that identify key climate impacts, data, and future projections, and partners ready to collaborate on implementing solutions.
- Increased adaptation measures now will decrease economic costs and safety risks in the future.

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Instructions
Does your agency/organization currently integrate planning for climate impacts into their strategy?

Option 1: Yes - 26
Option 2: No - 10
What sectors do you see as having the most potential for integrating climate information into adaptation?

- Freshwater and utilities: 20
- Fisheries and ocean resources: 18
- Public health & disaster management: 18
- Agroforestry and farming: 8
- Education: 8
- Coastal Infrastructure: 27
- Recreation and tourism: 3
- Cultural resources: 8
- Finance: 1
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Outline

- Application of NBS in the Pacific
- Resources to Evaluate NBS in American Samoa
- Challenges to NBS applications
- Opportunities for NBS in American Samoa
Nature Based Solutions in the Pacific

- Beach Restoration
- Dunes
- Reefs and Submerged Breakwaters
- Mangroves
- Stream Stabilization
Beach Restoration in Hawaii

Stable Road - Before and After Groin Field project

Sugar Cove Before and After Beach Restoration

Photos courtesy of Patti Cadiz
Beach Restoration in Hawaii

Iroquois Point, Oahu

Waikaloa, Big Island
March 11, 2011 Tsunami
Geotextile bag installed

Before and After T-Head groins

July 2011

Photos courtesy of Patti Cadiz
Dune Restoration on Maui

KANAHĀ: PRE DUNE RESTORATION
View: looking seaward (north)

destroyed coastal dune

substantial quantities of over-washed sand
due to human impacts and tsunami

12.01.2011

Tara Miller Owens

KANAHĀ: POST DUNE RESTORATION
View: looking seaward

restored coastal dune

foot path

parking area

sand fencing

06.02.2014

Tara Miller Owens

US Army Corps of Engineers

U.S. ARMY
Submerged Breakwaters/Artificial Reefs

Artificial reef balls that have been in place for about 10 years with some encrusting corals, North Sulawesi, Indonesia, October 2009.

Vision: Develop hybrid biological and engineered reef-mimicking structures to mitigate wave and storm damage that increasingly threaten DoD personnel and infrastructure.
Mangroves and their value to Samoa

"Scientists note that the dense root systems of mangrove forests trap sediments flowing down rivers and off the land. This helps stabilizes the coastline and prevents erosion from waves and storms. In areas where mangroves have been cleared, coastal damage from hurricanes and typhoons is much more severe. By filtering out sediments, the forests also protect coral reefs and seagrass meadows from being smothered in sediment."

One study estimates that globally, intact mangroves prevent US$82 billion in flood damage every year

https://www.huffpost.com/entry/mangroves-and-their-value-to-samoa_b_597903b7e4b06b305561cddb
Stream Stabilization

TRAINING MANUAL
THE VETIVER SYSTEM
By Robinson Varona
For The Vetiver Network International
In cooperation with
The Ministry of Waterways and Environment
Project Funded by GEF/UNDP through Fiji Ridge To Reef

VETIVER GRASS
Chrysothamnus zizanioides

GRASS
- HEDGEROWS FOR SOIL AND MOISTURE CONSERVATION
- BIOFUEL (BIOMASS, BRITTLELETS FOR COOKING, ETHANOL)
- THATCH FOR ROOFING
- HANDICRAFTS FOR HOME AND MARKETS
- LIVESTOCK FEED, MULCH AND SOIL RECONDITIONING

ROOTS
- ESSENTIAL OIL AND CRAFT PRODUCTION FOR MARKET
- SOIL STABILIZATION, EROSION CONTROL, AND GROUNDWATER RECHARGE
- REMOVE NITRATES, PHOSPHATES, HEAVY METALS, AND OTHER CONTAMINANTS
- TOLERANT TO SOILS WITH HIGH AND LOW pH, SALINITY AND HEAVY METALS
- DROUGHT AND FIRE RESISTANT
- CARBON SEQUESTRING

THICK CLUMPS TO 0.2 M DIAMETER
1.5M PER YEAR TO 3M AND MORE
AFTER 3 YEARS

Training Manual for Planting Vetiver
Resources for NBS Site Evaluation

USACE American Samoa Shoreline Atlas (2012)
Resources for NBS Site Evaluation

USACE Climate Related Vulnerability Assessment (2020)

- First step for the territory to collect existing data, identify data gaps, engage stakeholders and decision makers
- Most vulnerable transportation infrastructure was identified and conceptual adaptation strategies and order of magnitude cost estimates provided
- GIS geodatabase provided to leverage for future studies
- List of 12 recommendations for future work
USACE Climate Related Vulnerability Assessment (2020) – Sea Level Rise Estimates

Estimated Relative Sea Level Change Projections From 2020 To 2100 - Gauge: 1770000, Pago Pago, American Samoa, AS

- **SLR** by 2065 (45 yrs)
  - High estimate: 3.0 ft
  - Intermediate estimate: 2.0 ft
  - Low estimate: 1.5 ft
  - *rounded up to the nearest ½ foot

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Year
2020  2025  2030  2035  2040  2045  2050  2055  2060  2065  2070  2075  2080  2085  2090  2095  2100
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“start year”  +45 years  +80 years
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US Army Corps of Engineers

U.S. ARMY

[JPII CARAN CONSULTING LLC]

[IMag]
USACE Climate Related Vulnerability Assessment (2020) – GIS Data and SLR Inundation Data

American Samoa Vulnerability Map
American Samoa Post-Disaster Watershed Assessment

- Authorized by:
  - Section 729 WRDA 1986 - Watershed Studies
  - Supplemental Appropriations for Disaster Relief Act of 2019 (P.L. 116-20)

- Initiated following Tropical Cyclone Gita (2018)

- USACE Charge:
  - “watershed studies should inform multiple audiences and decision makers at all levels of government, and provide a strategic roadmap to inform future investment decisions by multiple agencies”

- Draft Report available January 2022
American Samoa Post-Disaster Watershed Assessment

Study Process:

Partner Input

- Problem Area Risk Assessment
- Likelihood vs. Consequence
- Rainfall
- Coastal Flooding & Erosion
- Water Quality & Supply
- Landslides
- Tsunamis

Risk and Uncertainty Analysis

- HIGH RISK
  - LOW UNCERTAINTY
  - Big Bold Actions Now
- HIGH RISK
  - HIGH UNCERTAINTY
  - Incremental Steps Now w/ Adaptive Management
- LOW RISK
  - LOW UNCERTAINTY
  - Longer Term Actions
- LOW RISK
  - HIGH UNCERTAINTY
  - Fill Data Gaps

Recommendations

Prioritized recommendations + implementation strategy
Challenges to NBS Applications

- High Wave Exposure Areas
- Areas with Narrow Coastal Plain
- Critical Coastal Infrastructure
Opportunities for NBS in American Samoa

- Utulei Beach Park – Beach Restoration (Regional Sediment Management Study 2016)

Figure 4. Failing concrete rubble from the American Samoa Shoreline Inventory masonry seawall protecting the park and fales in Reach B2. (USACE 2006, rev.2012).

Figure 10. CMS-Flow results during 1 yr south-southeast event on 6 September 2010 at 07:30. Alongshore current to the north while tidally ebb-driven flow is to the south during ebb tide.

Figure 11. CMS-Flow results during trade wind wave event on 21 September 2009 at 22:00. Nearshore flow is more complex during ebb tide.

Potential RSM Projects;
Utulei Beach Region, American Samoa

by Thomas D. Smith

American Samoa RSM: Numerical Modeling of Waves and Currents in the Utulei Beach Region

by Lauren K. Molina and Jessica H. Podoski
Opportunities for NBS in American Samoa

- Pala Lagoon – Mangrove Planting and/or Reef Balls

Table 10-4 - Cost estimate breakdown for manufacture and boom deployment of 60 reef balls

<table>
<thead>
<tr>
<th>Estimate with crane deployment</th>
<th>Qty</th>
<th>Unit cost (2075)</th>
<th>Estimate (2075)</th>
<th>Escalated (2020$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacture - Pallet Ball</td>
<td>60</td>
<td>$200</td>
<td>$12,000</td>
<td>$16,937</td>
</tr>
<tr>
<td>Mold purchase</td>
<td>1</td>
<td>$7,000</td>
<td>$7,000</td>
<td>$9,880</td>
</tr>
<tr>
<td>Mold Shipping</td>
<td>1</td>
<td>$3,000</td>
<td>$3,000</td>
<td>$4,234</td>
</tr>
<tr>
<td>Deployment: labor (unit cost per day)</td>
<td>10</td>
<td>$300</td>
<td>$3,000</td>
<td>$4,234</td>
</tr>
<tr>
<td>Loading (unit cost/hour)</td>
<td>80</td>
<td>$150</td>
<td>$12,000</td>
<td>$12,000</td>
</tr>
<tr>
<td>Interisland shipping of reef balls</td>
<td>0</td>
<td>$10,000</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Lift bags for placement (+$500 for shipping)</td>
<td>6</td>
<td>$250</td>
<td>$1,500</td>
<td>$2,000</td>
</tr>
<tr>
<td>Placement (unit cost/day)</td>
<td>10</td>
<td>$1,500</td>
<td>$15,000</td>
<td>$15,000</td>
</tr>
<tr>
<td>Pre-Deployment Survey (unit cost/day)</td>
<td>3</td>
<td>$500</td>
<td>$1,500</td>
<td>$2,117</td>
</tr>
<tr>
<td>Post-Deployment Monitoring (unit cost/day)</td>
<td>3</td>
<td>$500</td>
<td>$1,500</td>
<td>$2,117</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>$68,521</strong></td>
<td></td>
</tr>
</tbody>
</table>

* Blue text: local cost estimate; current dollars

Table 10-5 - ROM costs for planting for shore protection (2020 dollars)

<table>
<thead>
<tr>
<th>Planting Cost Components</th>
<th>Quantity</th>
<th>Unit Cost</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plants (Includes labor for planting)</td>
<td>1500</td>
<td>$5</td>
<td>$7,500</td>
</tr>
<tr>
<td>Cover mulch</td>
<td>31.5 cubic yards</td>
<td>$115</td>
<td>$3,620</td>
</tr>
<tr>
<td>Soil Amendment (optional)</td>
<td>31.5 cubic yards</td>
<td>$180</td>
<td>$5,667</td>
</tr>
<tr>
<td>Erosion Control Sheet material (optional)</td>
<td>5,000 square feet</td>
<td>Estimate by area</td>
<td>$600</td>
</tr>
<tr>
<td>Erosion Control Sheet installation (optional)</td>
<td>5,000 square feet</td>
<td>Estimate by area</td>
<td>$3,150</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>$20,537</strong></td>
</tr>
</tbody>
</table>

American Samoa Community College’s Land Grant Program works with local communities on out-planting from their nurseries to support environmental restoration efforts and may be able to assist with the provision of plants and labor.
CONTACT INFORMATION

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Nuisance flooding at Coconut Point in American Samoa; a glimpse of future everyday water levels
Instructions
Based on what you learned in this presentation, what kind of nature-based solution do you think is most applicable in American Samoa?
What do you see as the biggest challenge or impediment to using nature-based solutions in American Samoa?

1. Wave Climate
2. Resources (funding, people, interest)
3. Environmental Hurdles (permitting)
4. Sea Level Rise
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