AMERICAN SAMOA

COMMUNITY CLIMATE CHANGE RESILIENCY GUIDE

Prepared by the American Samoa Governor's Coral Reef Advisory Group – August 2012

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The following document produced for the Micronesia Conservation Trust and The Nature Conservancy served as a template for this Resiliency Guide and provided a great deal of the information regarding climate change impacts on small island communities and adaptation strategies for those impacts:

Gombos, M., Atkinson, S., & Wongbusarakum, S. 2010. *Adapting to a changing climate* (booklet). Retrieved from: http://www.cakex.org/virtual-library/3439

Additional information on regional climate change impacts and approaches to adaptation came from the following sources:

Amouli Village, National Oceanic and Atmospheric Administration – Pacific Island Regional Office, & American Samoa Coral Reef Advisory Group. 2011. *Draft Amouli Village Climate Resiliency Plan*. American Samoa Coral Reef Advisory Group.

Doherty, C., Peterson, W., Hattori, H., & Bucchianeri, K. 2012. *Draft Territorial Climate Change Adaptation Framework*. American Samoa Governor's Coral Reef Advisory Group.

Sauafea-Le'au, F. 2011. *Promoting Awareness and Establishing Climate Resilient Village Communities in American Samoa Through the Use of PLA approach*. Presentation for NOAA – PIRO Climate Change Summit 2011. Retrieved from: http://www.crag.as/ccs2011/Fatima_Sauafea_Leau_PLA.pdf .

South Pacific Environment Programme & United Nations Environment Programme. 2012. *Draft Pacific Environment and Climate Outlook 2012*. Retrieved from: http://sprep.org/attachments/reports/Draft_PECCO_June_2012.docx.

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Greenhouse Gas illustration on page 11 came from http://www.bigskyco2.org/whatisit/faqs/answers.

Photos:
Globe (page 5) - http://www.american.samoa.national-park.com/map.htm
American Samoa map (page 5) – American Samoa Department of Commerce GIS office
Storm with palms (page 6) - http://www.dreamstime.com/royalty-free-stock-images-storm-tropical-island-image3608839
Flooded trees and bleached coral (page 6) - http://pigcos.soest.hawaii.edu/piccp/joomla/
Fale (page 6) - http://www.ctahr.hawaii.edu/rwq/american_samoa/photogallery7.htm
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Cows (page 12) - http://sweetremedyfilm.blogspot.com/2012/06/genetically-modified-grass-kills-cattle.html
Rice plant (page 12) - http://fiehnlab.ucdavis.edu/projects/Rice_metabolome/
Tree stumps (page 12) - http://www.greeningforward.org/apps/photos/photo?photoid=87138779
Burning trash (page 12) - http://www.dreamstime.com/royalty-free-stock-images-burning-trash-pile-image1422489
Volcanoes (page 12) - http://en.wikipedia.org/wiki/Volcano
Researchers in forest (page 16), Hurricane by satellite (page 16), and Samoan traditional meeting (page 21) –
U.S. EPA. (2007) Climate change and interacting stressors: Implications for coral reef management in American Samoa. Global Change Research Program, National Center for Environmental Assessment, Washington, DC
Meeting group (page 21) - http://www.pifsc.noaa.gov/human_dimensions/socioeconomic_assessment_and_monitoring_in_american_samoa.php
Flooded plantation (page 23) - http://www.undp-adaptation.org/projects/websites/docs/KM/Satoalepai_Samoa_.pdf
Mangroves (page 23) - http://mangrovesforfiji.com/mangroves/mangroves-in-fiji/red-mangroves/samoan-mangrove
Flooded village (page 23) - http://www.undp-adaptation.org/projects/
Amouli map and sign (page 24) – Draft Amouli Village Climate Resiliency Plan
People gathered (page 24) - http://www.crag.as/ccs2011/Fatima_Sauafea_Leau_PLA.pdf

Purpose of This Guide

Coastal communities, including most villages in American Samoa, are particularly vulnerable to the impacts of climate change. Climate resiliency allows a community to prepare for, withstand, or quickly recover from those impacts to maintain local human and ecological health and security. This Guide is intended to be used by the villages of American Samoa to improve their climate resiliency through local planning and actions. This document describes potential community based climate adaptation strategies, what other communities have done, and how an American Samoan village can act to become more resilient to the impacts of climate change. This Guide compliments the American Samoa Territorial Climate Change Framework by showing how a resilient coastal community with well managed natural resources can support healthy community members for generations to come.

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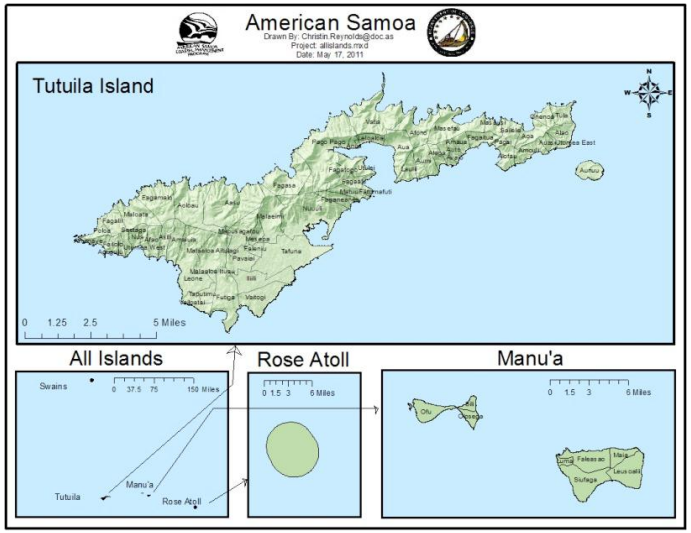
American Samoa and Climate Change – An Introduction



American Samoa, like most other small isolated tropical islands, is particularly vulnerable to the impacts of climate change. Several factors contribute to American Samoa's high vulnerability. Tropical cyclones may occur any time during the summer months. The islands' limited livable coastlines and steep mountains reduce adaptation options. Most communities are situated in low-lying coastal zones vulnerable to sea level rise and the impacts of increased storm surge.

Historic overexploitation has stressed local natural resources and caused land and marine ecosystems to become less resilient to the impacts of climate change. Those impacts include loss of coastal land due to erosion and sea level rise, loss of coral, fish, and other important species, intensified tropical storms that may cause further environmental and economic damage, and an increase in human health risks from disease and limited drinking water.

To address this vulnerability and improve their resiliency to the impacts of climate change, communities can plan in advance and work to prevent or prepare for those predicted impacts. This document describes how each American Samoan village can create its own Climate Resiliency Plan to become more self-sufficient, resilient to climate change impacts, and create a healthier community in the process.

Climate Change Impacts of Primary Concern

Stronger Storms and Changing Rain Patterns

Storms are expected to increase in number and severity, with more building damage and erosion in low-lying areas. Storms can also damage coral reefs and reduce the reefs' ability to protect the coast from wave erosion. Coral damage will also decrease the fish and other important organisms that depend on the reef. Rainfall patterns are expected to change, with the most likely effect of more intense rain when it occurs. Thus wet periods will see more erosion. More pooled water after the rain may increase the incidence of diseases like dengue fever.

Sea Level Rise

Communities, agriculture, and infrastructure concentrated in low-lying areas of American Samoa are vulnerable to the expected sea level rise associated with climate change. Rising sea level will cause submersion of coastal land, increased intensity of storm surge and wave erosion further inland, and reduction or contamination of freshwater sources. American Samoa's extremely steep hillsides make building inland difficult, so communities will need to prepare for the changes expected from rising seas.

Coral Bleaching, Disease, and Loss of Structure

Increasing sea surface temperature and increasing ocean acidity, both expected in coming years, will cause more coral bleaching, disease, and loss of reef structure. Coral loss will lead to further loss of fish and other reef species that provide food, incomes, and the future draw of tourists to American Samoa. Loss of reef structure will remove the protective function of the reef to break wave energy. Communities can address these impacts by minimizing their own impacts on coral, fish, and other species in and around the reef.

Human Health and Security

Samoans have used the natural environment for food, supplies, and protection for centuries. Climate change and overuse of natural resources can reduce available clean water for drinking and agriculture, reduce land available for growing food, reduce fish and other resources from the sea, increase local dependence on imported food and other materials, increase coastal storm and erosion damage, and increase harmful diseases on land and in the ocean. Working together, communities can prepare for and limit these impacts.

A Healthy American Samoan Community

A Healthy American Samoan Community

A healthy natural environment has provided abundant resources and protection to American Samoan communities for thousands of years. Healthy, well-managed natural resources can continue to provide those functions for the local communities. They can also provide important safeguards against the impacts of climate change.

Watersheds with well-managed native vegetation

- Reduce landslides and soil erosion
- Reduce stream erosion from run-off after rains
- Filter water used for drinking and agriculture
- Provide habitat for important animals
- Protect reefs from sediment and pollution damage

Coastlines and Beaches with limited development

- Protect inland areas from storm damage and erosion
- Provide recreational areas for local residents
- Provide nesting areas for turtles, birds, and other animals

Healthy Mangroves and Seagrass Beds

- Protect inland areas from storm damage and erosion
- Protect inland homes and agriculture from salt spray damage
- Provide critical habitat, nurseries, and feeding grounds for many important fish and invertebrates that later move to the reef or further to sea
- Trap sediments and nutrients from land and prevent them from damaging coral reefs

Healthy Coral Reefs

- Cause waves to break on the reef crest, reducing wave erosion and storm surge impacts on the coast
- Provide habitat, nurseries, and feeding grounds for an incredible variety of fish and invertebrates, which support a variety of marine life including tuna, groupers, sharks, turtles, and dolphins
- Provide safe swimming and recreational areas in flats and pools inside the reef crest
- Provide income for local businesses from tourists visiting to experience the reef

American Samoan resource knowledge and stewardship

- Provide sustainable amounts of food, building materials, and firewood for families
- Provide long-term income from well-managed agriculture and livestock
- Promote self-sufficiency by protecting natural resources for long-term health
- Promote awareness and celebration of cultural connections to island plants and animals on land and in the sea
- Recognize that a healthy island environment supports healthy people with food, water, and security

A Threatened American Samoan Community – Situations to Avoid

A Threatened American Samoan Community – Situations to Avoid

An overused and threatened natural environment cannot provide the same abundant resources and protection for American Samoan communities as the healthy environment. A degraded environment will provide less now, and it will make communities more vulnerable to the future impacts of climate change. This list includes situations a community should AVOID.

Threatened Watersheds

- Have widespread clearing and burning of native forests and other vegetation, particularly along stream banks, leading to increased erosion
- Have poorly planned construction leading to further erosion
- Have significant pollution and sediment run-off from local land uses, such as pesticides and fertilizers from crops and waste from piggeries, that degrade water quality for humans and harm plants and animals in the ocean
- Have widespread invasive plants that do not support native species

Threatened Coastlines and Beaches

- Have significant development along the shoreline vulnerable to erosion and storm damage
- Have limited nesting areas for turtles and other animals
- Have loss of mangroves and seagrass beds, causing erosion, water pollution, and loss of habitat for native species
- Have sand dredging that harms coral reef systems
- Have polluted waters that threaten human health in recreational areas
- Have invasive species outcompeting native species

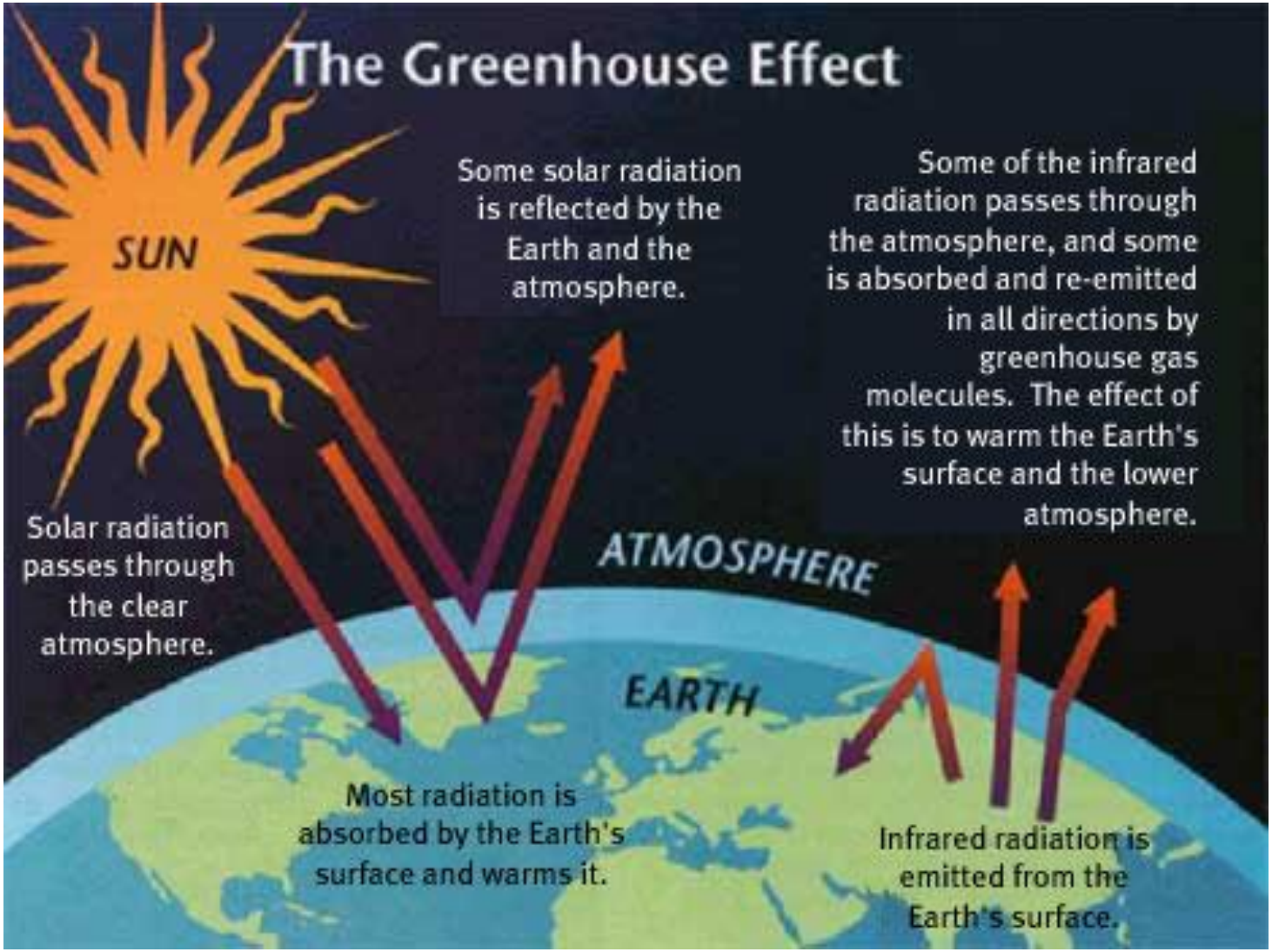
Threatened Coral Reefs

- Have destructive fishing practices occurring, such as dynamite fishing, which can destroy the reef and eliminate habitat for fish and other important species
- Have overharvested local fish through practices such as scuba spearfishing, spearfishing at night, or using small mesh nets or gill nets, leading to much less fish available in the future. Fewer fish can also lead to excessive algae growth which can smother coral on the reef
- Have uneducated community members and tourists touching and walking on live coral, killing the coral
- Have less coastal protection from erosion and storms

Threatened Local Communities

- Have limited access to clean drinking water
- Have fewer resources to provide local food supplies or to support incomes through sustainable crops or livestock
- Have buildings, crops, and animals in areas prone to erosion and flood damage
- Have lost traditional knowledge and cultural ties to the environment and are less able to use natural resources in a sustainable way
- Have increased illnesses due to limited clean drinking water, dependence on imported foods, and an increase in diseases thriving in disturbed environments

What is Climate Change?



What is Climate Change?

The sun is the primary source of energy for our planet. It drives our climates and weather patterns. Plants capture part of the sun's energy in their cells and make it available to animals and human communities through food. The land and the oceans absorb some of the sun's energy, which makes our planet warm enough to support life. Some of that energy absorbed by land and water is radiated back out from the surface and captured in the atmosphere by Greenhouse Gases. This is known as the Greenhouse Effect.

Without Greenhouse Gases in the atmosphere, including water vapor, Carbon Dioxide, Nitrous Oxide, and Methane, Earth would lose too much energy and our planet would be much colder. Throughout recorded time the amount of Greenhouse Gases in the atmosphere has changed very slowly and caused periodic climate change with warmer and colder periods in the past. Natural sources have added Greenhouse Gases to the atmosphere in small amounts in the past. Plants on land and in the ocean have taken Greenhouse Gases out of the atmosphere and helped maintain a balance.

Unfortunately, human activities in the recent past have dramatically increased the amount of Greenhouse Gases going into the atmosphere and reduced the amount taken out, leading to a much faster rise in air, land, and sea temperatures. That rapid rise in temperature leads to climate change, which can cause many of the impacts to the natural resources and communities of American Samoa described in this document.

Greenhouse Gases come from:

- Burning diesel, gasoline, oil, and coal
- Large numbers of cattle and sheep
- Agriculture
- Deforestation
- Fires (natural and man-made)
- Volcanoes (natural source)

What Changes Can American Samoa Expect?

What Changes Can American Samoa Expect?

The climate change described on the previous pages will have significant impacts on the natural and human environments of American Samoa. By following the steps outlined later in this document, American Samoans can prepare for many of those impacts and create more resilient communities, stronger and better protected from the current and future impacts of climate change. The following are some of the major climate change impacts American Samoan communities can expect to experience now and in the future.

Changes in Weather Patterns

- Rains patterns will change with heavier and more intense rains when they occur, leading to increased floods, landslides, and erosion
- Increases in plant, animal, and human diseases from changes in native plant communities and new pools of still water

Rising Air, Land, and Sea Temperatures

- Agricultural loss due to higher temperatures and drought, leading to loss of income and more dependence on imported foods
- Coral bleaching, leading to loss of fish diversity, other marine life, and loss of income
- Increases in coral, fish, and other marine diseases with the loss of native coral reef communities

Sea Level Rise

- Storm surge, floods, and erosion reaching farther inland, damaging crops, homes, and coastal infrastructure
- Fresh water sources becoming saturated with salt water from the sea

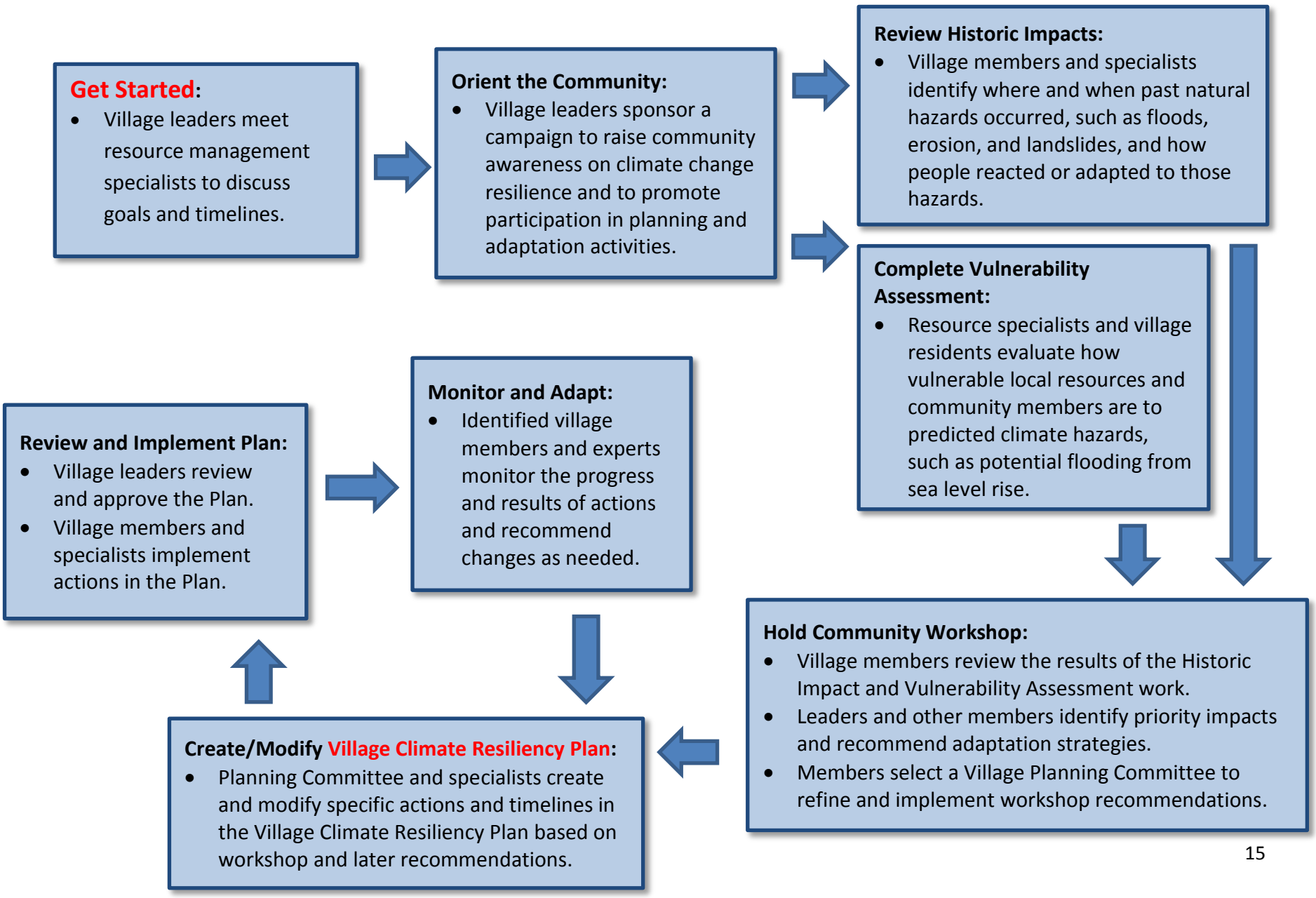
Ocean Acidification

- Reef structure deterioration, leading to more damaging and erosive storm and wave action on the coast
- Further loss of reef as feeding and nursery grounds for fish and other important marine life

Community Health and Safety

- Loss of income due to impacts on crops, natural resources, fish, and other marine species
- Loss of buildings, roads, and other infrastructure from increased storms, flooding, and erosion
- Health concerns associated with increased prevalence of diseases and decreased clean drinking water
- Loss of cultural ties to the natural environment as resources become less available and less supportive

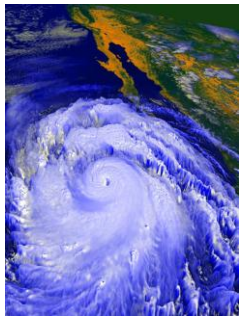
How to Make an American Samoan Village More Resilient to Climate Change



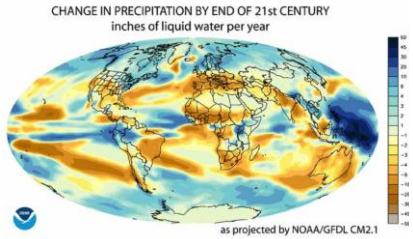
Historic Impact Review and Vulnerability Assessment

Historic threats and root causes
Historic and current resource mapping
Existing adaptation strategies

Biophysical Assessment
Land and Ocean surveys



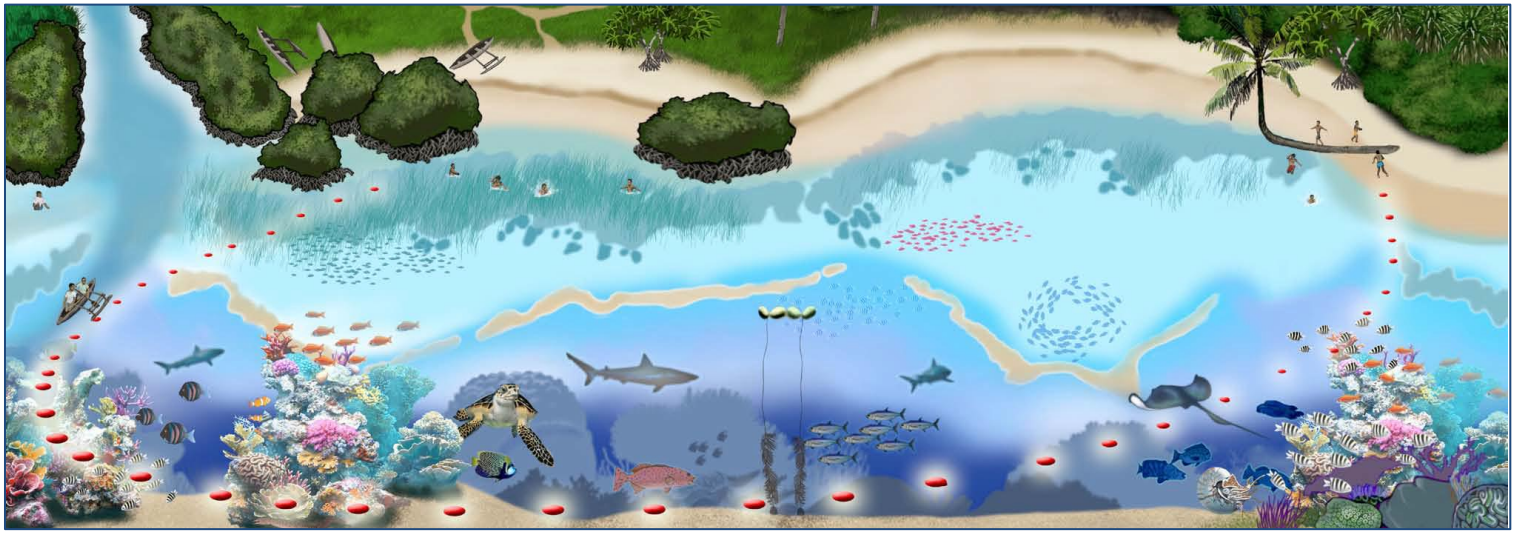
Climate &
Resource Sciences



Village's Vulnerable Resources Identified in Review and Assessment

Resource	Threats	Exposure	Impacts	Vulnerability	Adaptation Strategies
Water resources	Salt inundation Contamination Limited supply	Entire village	Less drinking water Damaged crops Human health loss	High – all people will be effected	Conserve water Grey water system Reduce water pollution
Coral reefs	Dynamite Overfishing Sea temperature	All reefs	Bleaching Loss of fish Severe coastal erosion	Medium - some coral can recover from bleaching	Educate the public Create fishing limits Create protected areas
Resource	Threat	Exposure	Impact	Vulnerability	Strategy
Resource	Threat	Exposure	Impact	Vulnerability	Strategy

Sample Adaptation Strategies – Coral Reefs and Fisheries



- Use a locally managed Marine Protected Areas to:
  - Protect fish that eat algae and prevent it from smothering coral
  - Establish no-take areas or time periods (i.e. spawning season) to maintain fish for future use
  - Protect reefs against coral removal or damage by anchors, debris/trash, or human feet
  - Reduce land-based pollution and sediment run-off to reduce its impact on coral reef habitats
- Use small-scale pond aquaculture, when appropriate, to provide a more sustainable source of food without overfishing the reef
- Develop alternative incomes based on maintaining a healthy reef, such as eco-tourism or assistance with scientific research
- Develop marine education and outreach programs so community members understand a healthy marine world supports a healthy community

Sample Adaptation Strategies – Coastal Land, Vegetation, and Agriculture

- Use wise agricultural practices: reduce water, fertilizers, and pesticides, use mulching and terracing when appropriate
- Use wet cropping species, such as taro, in low-lying areas, move agriculture inland when possible
- Avoid clearing large areas of land for single crop species
- Use traditional, less costly food preservation methods
- Replace invasive species with native vegetation
- Eat local foods to support local, sustainable agriculture
- Use renewable energy sources, such as solar, and reduce reliance on native vegetation
- Protect and replant mangroves and seagrasses
- Establish soft (vegetation) and hard (seawalls) coastal protection where appropriate
- Integrate traditional agricultural knowledge into education programs to support continued use of sustainable practices

Sample Adaptation Strategies – Water Resources

- Install household or community rain water catchment systems for use with agriculture, lawns, and non-drinking household water
- Install a grey-water system, routing filtered sink and shower water outside or to household non-drinking water uses
- Protect freshwater ponds, lakes, and streams from trash, fertilizers, pesticides, animal waste products, and other pollutants
- Monitor well water volume and purity, establish use limits if needed
- Establish regular drinking water testing to ensure quality supplies for human use
- Use solar water filters with questionable water sources for crops and to supplement drinking water if needed
- Repair leaking pipes and faucets as soon as possible

Sample Adaptation Strategies – Community Health and Safety

- Reduce human threats to natural resources
  - Reduce water pollution from trash, animals, and crops
  - Reduce overfishing and damage to coral reefs
  - Reduce clearing and burning of native vegetation
  - Conserve water use as described on a previous page
- Build structures inland when possible, reinforce existing coastal buildings and raise on stilts when necessary
- Provide an early warning system for natural disasters and other emergencies
- Organize groups for medical and evacuation support during floods, storms, and other emergencies
- Organize local monitoring and enforcement of resource protection, such as fishing limits and waste disposal rules
- Provide education and outreach programs on the many ways community members can prepare for climate change
  - Include traditional sustainable knowledge and skills
  - Connect preparedness to security and health
  - Include services offered in and outside the community
  - Offer opportunities for members to contribute

Sample Adaptation Strategies – Local and Regional Cooperation

- Build partnerships with local organizations, such as the Coral Reef Advisory Group and other groups listed in this document, to plan and implement a Village Climate Resiliency Plan

- Establish resource monitoring programs, such as reef, fish, and pollution run-off monitoring, to evaluate local resource health and Resiliency Plan effectiveness. Use available Territorial assistance, such the Department of Marine and Wildlife Resources, to build these programs

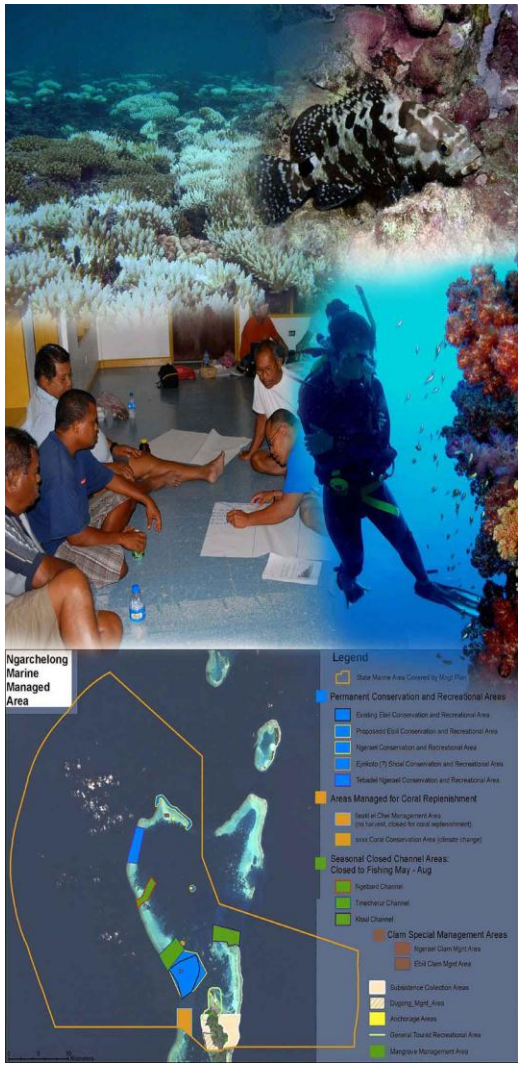
- Work with other American Samoan communities to share knowledge, strategies, and resources when appropriate

- Encourage community members to attend local and regional meetings and conferences related to climate change resilience to exchange knowledge and experience

- Ensure community members know about and have access to health care and other services available for their use

What Are Other Island Communities Doing?

Ngarchelong Community, Republic of Palau - Climate Resiliency Plan



To prepare for and adapt to climate change impacts on their local natural resources, the Ngarchelong Community in Palau chose to build resiliency into the design of their marine managed area. They identified specific past, current, and future threats, assessed the vulnerability of their resources, and developed specific action plans to build the resilience of their marine resources to future impacts from climate change. The following are some examples of threats they identified and actions they took.

Threats Identified

- Mass bleaching of coral reefs occurred in 1997 and 1998
- Increased sea temperatures leading to increased coral bleaching could cause large-scale coral death and reduce the availability of fish for food, reduce tourism and local incomes, and the reef may no longer protect the coast from storm surge or erosion

Actions Taken

- Working with the government, resource management specialists, scientists, and local conservation groups, the community established MPAs designed to offer long-term support for the local coral reefs and fisheries
- The community team working on the MPAs considered current and future impacts of climate change in MPA design. They recommended additional levels of protection for areas that have shown resistance to or recovery from past coral bleaching events as well as for area where critical fish spawning occurs

What Are Other Island Communities Doing?

Villages in Independent Samoa - Climate Resiliency Plans

Many villages in the Independent State of Samoa are currently identifying their resources at most risk to the impacts of climate change and using adaptation strategies to increase their resilience to those impacts. Below are a few examples of the resources and impacts they have identified and the actions they are taking.

Satoalepai Village

- Impact/Threat - Wetlands surrounded by roads and other raised lands no longer drain naturally. Increased flooding due to sea level rise will build up water in these restricted areas and damage houses, agricultural land, and wetland vegetation
- Action - The Village is building box culverts to restore natural drainage and protect the community

Avao Village

- Impact/Threat - Avao has experienced rapid erosion over the past 10 years and has lost homes, graves, and beach fales from sea level rise and storm waves
- Action - The Village is replanting mangroves for coastal protection and has banned deforestation along streams to reduce erosion. These actions will lead to filtration of run-off from land and protect coral and fish as well

Lelepa Village

- Impact/Threat - Water and electricity come to Lelepa along a low-lying road within the coastal flood hazard zone and will likely be impacted by rising seas
- Action - The road is being raised and fitted with drains at wetland crossing points to protect services to the Village without reducing the natural water drainage system

Taking Action in American Samoa

Amouli Village Climate Resiliency Plan

Amouli Village Climate Resiliency Plan

Amouli Village developed the first community resiliency plan in American Samoa. The Village participated in the resiliency planning process to prepare for and reduce the potential impacts of climate change on its community and natural resources. To ensure that the Village Planning Committee reflected a variety of community perspectives, the Committee included key Village leaders and representative of different Village sectors, including women, untitled men, and youth. The Village Planning Committee and resource management specialists used information collected from a community workshop to discuss vulnerabilities, adaptation strategies, adaptation timelines, and key objectives for priority climate change impacts. Amouli is actively implementing its plans and will continue to refine and modify its goals and actions to create a community better prepared for the impacts of climate change.

The chart below shows an example of a major climate change impact identified by Amouli planning participants, the objectives and actions they chose to address that impact, and the lead group for each action.

Sample Impact, Objectives, and Actions from Amouli Village Climate Resiliency Plan

Impact	Objective	Action	Lead Group
Tropical Storms	Emergency and Disaster Shelters with an emergency medical plan by 2012	Three shelters	Village Council
		Emergency Response Plan	
		Village outreach about Plan	
	Emergency and Disaster Teams, trained and ready to help by 2012	Team of volunteers	Village Council
		Team training	
		Team equipment	
		Rescue transport vehicles	
	Half of families trained and prepared by 2012	Education and awareness program	Village Mayor and Planning Committee
		Preparedness visits by Mayor	
		Tree planting and agriculture training for storm protection	

Where Your Community Can Get More Help Adapting to Climate Change

The following local, regional, and Federal agencies and groups can provide assistance to the villages of American Samoa as they advance through the climate change resiliency planning and implementation process described in this Guide. The American Samoa Coral Reef Advisory Group (CRAG) is the lead organization in the effort to increase climate resiliency for all American Samoan communities. Village leaders are encouraged to contact CRAG to ensure their village remains strong and healthy for many generations by planning for and adapting to climate change impacts now.

Agency/Group	Expertise/Resources	Contact Information
AS Coral Reef Advisory Group (CRAG)	Lead American Samoan organization for climate resiliency planning and adaptation	Whitney Peterson (684) 633-5155 ext.229
AS Dept. of Marine and Wildlife Resources	Community-based Fisheries Management Program; assessment and monitoring of marine resources	(684) 633-5102
AS Environmental Protection Agency	Protect air, water, and land upon which residents rely	(684) 633-2304
ASCC Sea Grant Program	Sustainable aquaculture and other marine uses	(684) 699-9155
ASCC Land Grant Program	Sustainable agriculture, forestry, and other land uses	(684) 699-9155
US National Park Service – American Samoa	Management of Park Service land, sea, and programs	(684) 633-7082
USDA Natural Resource Conservation Service	Wise practices in agriculture and other land uses	(684) 633-1031
NOAA Pacific Island Regional Office	Lead Federal agency for climate resiliency planning and adaptation	Fatima Sauafea-Le'au (684) 633-5326
Fagatele Bay National Marine Sanctuary Program	Education & Outreach; Economic Valuation; Strategic Planning & Reporting; Marine Research	Emily Gaskin (684) 633-6500
AS Coastal Zone Management Program	Land-use permitting and protection of coastal and marine resources	(684) 633-5155 ext. 276
AS Dept. of Public Safety	Protection and enforcement in American Samoa territory	(684) 633-1111
AS Marine Patrol	Protection and enforcement in American Samoa waters	(684) 633-2004
US Dept. of Homeland Security	Security and protection for all residents in American Samoa	(684) 633-1405
AS Emergency Medical Services	Emergency medical services and support	(684) 633-5003
AS Office of Samoan Affairs	Protection of traditional culture and laws	(684) 633-5201
AS Youth Groups (Village and Church based)	Assistance with implementation of adaptation strategies	Contact group leaders