Climate Change Adaptation for Coral Triangle Communities:

A Guide for Vulnerability Assessment and Local Early Action Planning (LEAP Guide)

CORAL TRIANGLE INITIATIVE
ON CORAL REEFS, FISHERIES AND FOOD SECURITY

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The U.S. Coral Triangle Initiative (US CTI) Support Program was established through the support of the U.S. Government to assist the leadership of the Coral Triangle countries to take action to maintain the coral reefs, fisheries, and food security of the Coral Triangle. US CTI is a coordinated effort of the Coral Triangle Support Partnership (CTSP, a consortium of World Wildlife Fund (WWF), Conservation International (CI), and The Nature Conservancy); the U.S. National Oceanic and Atmospheric Administration (NOAA); the U.S. Department of State; and other partners. Spearheaded by the U.S. Agency for International Development Regional Development Mission Asia in collaboration with USAID/ Indonesia, USAID/ Philippines, and USAID/ Timor-Leste, the program assists the six countries of the Coral Triangle and the CTI Regional Secretariat to implement their Regional and National Plans of Action through technical assistance and capacity-building, and access to cutting-edge science.

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For more information
Visit the US CTI Support Program online at www.uscti.org
Visit the Coral Triangle Initiative online at www.coraltriangleinitiative.org

Front cover photo: Children playing on a beach in the Solomon Islands © Bruno Manele
Back cover photo: Beach erosion in Njari Island, Solomon Islands © Asuncion Sia

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Foreword

Coastal communities in the Coral Triangle are experiencing the impacts of climate change. Severe storms, coastal inundation, rising sea level and sea surface temperatures are threatening safety and food security of more than 120 million people that depend directly on local marine and coastal resources for their income and livelihoods. Climate change is emerging as a serious issue for our region's communities.

The Coral Triangle Initiative for Coral Reefs, Fisheries and Food Security (CTI-CFF) was founded on the commitment of the six Coral Triangle countries (CT6): Indonesia, Malaysia, Papua New Guinea, the Philippines, Timor-leste and the Solomon Islands, to accelerate efforts to safeguard the coastal and marine resources and communities. As part of this commitment, the CT6 embodies *Climate Change Adaptation (CCA)* as one of the five key goals within the CTI-CFF Regional Plan of Action, pledging to implement actions to reduce the impacts of and adapt to climate change.

The 2011 Region-wide Early Action Plan for Climate Change Adaptation developed by the CT6, through the CCA Technical Working Group (CCA TWG), identifies local early actions that need to be implemented throughout the region. This Guide to Vulnerability Assessment and Local Early Action Planning (LEAP) was developed as a companion document to assist local governments and communities in identifying strategic and practical actions to address the impacts of climate change.

The LEAP Guide is not intended to be a stand-alone document but complements other national, regional and international frameworks, strategies and plans. The Guide should inspire users on the realities, challenges, successes and future of coastal communities, local and national governments of the region.

We take pride in this progress and do hope that the Guide is a practical and effective resource-book in addressing the present and future socio-economical and environmental political challenges faced by coastal communities.

We thank all involved in developing and piloting the LEAP Guide throughout the region. Special thanks to the USAID and the USCTI Support Program for providing the technical assistance in developing the Guide and providing training to help catalyse planned adaptation in the region.

CTI-CFF Climate Change Adaptation Technical Working Group (CCA TWG) Co-Chairs

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This guide was developed under the direction of and reviewed by the Coral Triangle Initiative (CTI) Climate Change Adaptation (CCA) Technical Working Group (TWG). The CCA TWG recognized the need for guidance to support local implementation of the CTI Region-wide Early Action Plan for Climate Change Adaptation (REAP-CCA). The CCA TWG was engaged throughout the development of the guide and reviewed multiple versions. CCA TWG members include:

- **Indonesia:** Sri Tantri Arundati and Tri Widayati, Ministry of Environment; M. Eko Rudianto, and Syofyan Hasan, Ministry of Marine Affairs and Fisheries
- **Malaysia:** Nor Aieni Haji Mokhtar, Ministry of Science, Technology and Innovation; Ejria Saleh, Universiti Malaysia Sabah and Evelyn Teh, Maritime Institute of Malaysia
- **Papua New Guinea:** Kay Kalim Kumaras, Department of Environment and Conservation; Luanne Losi, Office of Climate Change and Development
- **Philippines:** Lynette Larroya, Coastal and Marine Management Office of the Department of Environment and Natural Resources; Luz Baskiñas, Worldwide Fund for Nature
- **Solomon Islands:** Agnetha Vave-Karamui and Hudson Kauhiona, Ministry of Environment, Climate Change, Disaster Management and Meteorology (MECDM)
- **Timor-Leste:** Rui Pires, Ministry of Environment

The US CTI Support Program provided technical assistance in the preparation, writing, editing, layout, and printing of the guide. The design and development of this document was led by (in alphabetical order) Scott Atkinson (Conservation International), Catherine Courtney, Ph.D. (Tetra Tech, Inc.), Kathleen Flower, Ph.D. (Conservation International), Meghan Gombos (Sea Change Consulting), and Britt Parker (US National Oceanic and Atmospheric Administration). Editing was conducted by Debbie Gowensmith. Layout and graphics for the guide were developed by Ysolde Jatulan. Some graphics in Step Two: Telling Your Climate Story, were adapted from the original work of Sevuloni Tora.

We are grateful to Elizabeth McLeod, Ph.D. (The Nature Conservancy) and Paul Marshall, Ph.D. (Australian Great Barrier Reef Marine Park Authority), who reviewed the guide and provided valuable input at critical stages in the development process. Technical guidance in overall development of this document provided by Renerio Acosta (USAID).

Some of the content within this document was developed through the willingness of conservation practitioners and organizations to share their guides, tools, and lessons learned to further community-based adaptation to climate change. The work of a number of individuals and organizations was shared and adapted for use in this guide, including the following:

- Micronesia Conservation Trust (MCT) and local Micronesian partners, including government agencies, nongovernmental organizations (NGOs), and community members, and from the

Pacific Islands Managed & Protected Area Community (PIMPAC) Management Planning Guidance (2011);
- Meghan Gombos, Scott Atkinson, and Supin Wongbusarakum's 2010 booklet, "Adapting to a Changing Climate";
- Sustainable Coastal Communities and Ecosystems project, implemented by the University of Rhode Island's Coastal Resources Center and the Coastal Management Advisory Council of the Republic of the Marshall Islands, the University of the Philippines Marine Science Institute;
- The Nature Conservancy's Reef Resilience Toolkit; and
- NOAA Office of National Marine Sanctuaries "Climate Smart Sanctuaries: Helping the National Marine Sanctuary System Address Climate Change".

This guide was piloted through regional training events and in field sites involving all six Coral Triangle countries. We wish to acknowledge the following individuals and organizations for providing valuable input from the piloting, which was used to improve the guide:
- Kirsten Abernethy and Zelda Hilly of WorldFish and Shannon Seeto and Salome Topo of WWF-Solomon Islands in two communities in Gizo, Western Province;
- Annisah Sapul and Ruth Konia of TNC in Kimbe Bay and Manus, Papua New Guinea;
- Cliff Marlessy of the Indonesia Locally-Managed Marine Area (LMMA) Foundation in two sites in eastern Indonesia (Kei Islands and Padaido Islands);
- Indonesia Marine and Climate Support Project in two provinces in Indonesia (Nusa Tenggara Barat and Sulawesi Tenggara);
- Rui Pinto and Candice Mohan (CI) in villages inside Nino Konis Santana National Park, Timor-Leste;
- Evangeline Miclat (CI) in Verde Island Passage;
- Porfirio Aliño, Milidel Quibilan, Kubi Fallosco (University of Philippines Marine Science Institute) in various sites in the Philippines; and
- Ejria Saleh in Tun Mustapha Park, Malaysia.

This guide complements guidance provided in "Moving Toward Ecosystem-based Coastal Area and Fisheries Management in the Coral Triangle: Integrated Strategies and Guidance," developed by the US CTI Support Program.

Acronyms

CCA	Climate Change Adaptation
CI	Conservation International
CTI	Coral Triangle Initiative
CTI-CFF	Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security
CTSP	Coral Triangle Support Partnership
EBM	Ecosystem-based management
IPCC	Intergovernmental Panel on Climate Change
LEAP	Local Early Action Plan
LMMA	Locally managed marine area
MCT	Micronesia Conservation Trust
NOAA	National Oceanic and Atmospheric Administration
NPOA	National Plan of Action
PIMPAC	Pacific Islands Managed & Protected Area Community
REAP-CCA	Region-wide Early Action Plan for Climate Change Adaptation
RPOA	Regional Plan of Action
TNC	The Nature Conservancy
TWG	Technical Working Group
USAID	U.S. Agency for International Development
US CTI	U.S. Coral Triangle Initiative
US IOTWS	U.S. Indian Ocean Tsunami Warning System Program
WWF	World Wildlife Fund

Introduction

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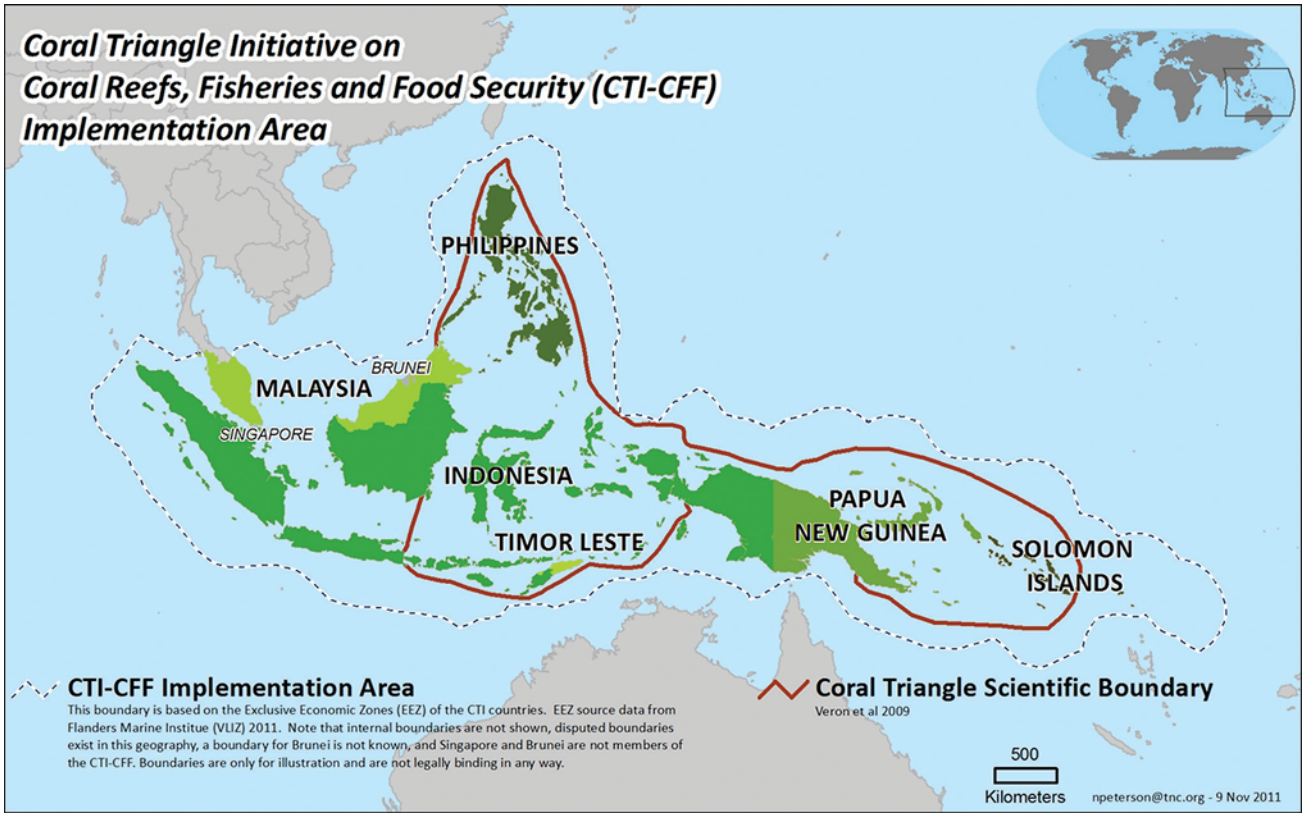
The Coral Triangle is located along the equator at the confluence of the Western Pacific Ocean and Indian Ocean. It covers all or part of the exclusive economic zones of six countries: Indonesia, Malaysia, Papua New Guinea, the Philippines, the Solomon Islands, and Timor-Leste. Considered the global epicenter of marine life abundance and diversity, the Coral Triangle possesses 76 percent of all known coral species, 37 percent of all known coral reef fish species, 53 percent of the world's coral reefs, the greatest extent of mangrove forests in the world, and spawning and juvenile growth areas for the world's largest tuna fishery (Veron et al., 2009). Climate change will dramatically affect coastal and marine ecosystems in the Coral Triangle. Sea-level rise, storm surge, sea surface temperature rise, ocean acidification, and other climate change related impacts increase risks to Coral Triangle communities and the natural resources upon which they depend.

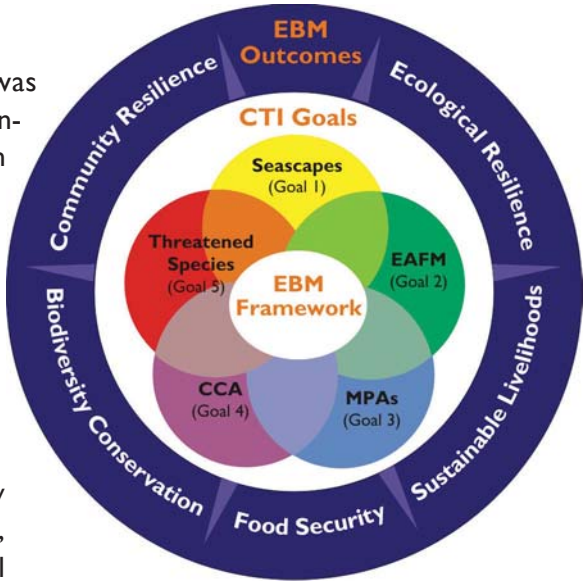
The six Coral Triangle countries came together in 2007 to form a multilateral partnership called the Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security (CTI-CFF) to safeguard the marine and coastal resources of the Coral Triangle region. The CTI-CFF Regional Plan of Action (RPOA) was



Map of the Coral Triangle Region

launched in 2009 by the leaders of the six Coral Triangle countries. The RPOA adopts ecosystem-based management (EBM) as a framework for marine and coastal management (CTI-CFF, 2009). One of five goals identified in the CTI-CFF RPOA, "Goal 4: Climate Change Adaptation Measures Achieved," targets reducing the vulnerability of communities to climate change. Planned climate adaptation must be considered in all CTI-CFF RPOA goals. Reducing risks from coastal hazards including those related to climate change is critical to achieving social and ecological resilience and other outcomes of EBM (US CTI Support Program, 2013).

The importance of addressing climate change was reinforced through the development of the "Region-wide Early Action Plan for Climate Change Adaptation for the Nearshore Marine and Coastal Environment and Small Island Ecosystems (REAP-CCA)" (CTI-CFF, 2011). The six Coral Triangle countries adopted the REAP-CCA as a guiding framework. The REAP-CCA sets forth urgent and immediate actions that need to be taken across the Coral Triangle to build coastal community resilience to climate change (CTI-CFF, 2011). This guide, *Climate Change Adaptation for Coral Triangle Communities: A Guide for Vulnerability Assessment and Local Early Action Planning* (*LEAP Guide*), was developed to catalyze local early action in coastal communities through education and outreach, vulnerability assessment, and local early action planning.



Alignment of EBM outcomes and the five CTI-CFF RPOA goals
(US CTI Support Program, 2013)

Need for Local Early Action to Address Climate Change

Climate change is the change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties that persist for an extended period, typically decades or longer (United Nations Intergovernmental Panel on Climate Change, or IPCC, 2001). Increasing air temperature and sea surface temperature are among the indicators of climate change resulting from increasing atmospheric concentrations of greenhouses gases such as carbon dioxide and methane caused by the burning of fossil fuels. The impacts of climate change – such as coastal flooding, coral bleaching, and changes in fish populations – will affect the built and natural environment, livelihoods, and food security (Hoegh-Guldberger et al., 2009; Bell et al., 2011). Understanding the extent of these changes and their impacts and identifying early adaptation actions is essential to protecting communities and marine and coastal resources in the Coral Triangle.

While national government agencies in the Coral Triangle play a critical role in developing regional and national climate policies, local governments and communities are on the front line of adaptation. Many communities are reporting that they are experiencing the impacts of climate change and variability. Community freshwater water supplies on small islands are being affected by increased coastal inundation. Fishing grounds traditionally used by a community have migrated farther offshore. Severe storms have destroyed homes and livelihoods. Many communities are reacting to climate-related changes and variability by adapting practices and infrastructure to minimize impacts.

CCA is the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Generally, three types of adaptation are recognized: reactive, maladaptation, and planned. Planned adaptation helps communities anticipate changes in order to minimize impacts and increase social and ecological resilience. Reactive and certainly maladaptive actions can lead to unintended consequences that actually lower resilience. Climate change adaptation is a scientifically and socially complex issue in the Coral Triangle and globally. Understanding climate science, planning based on future scenarios, integrating social values and priorities, and addressing both social and ecological vulnerabilities in resource-dependent communities are areas of practice being grappled with in developing as well as developed countries.

A key challenge is to catalyze planned adaptation within an ongoing development process that is aligned with the community goals and objectives (USAID, 2013). The steps for planned adaptation in the LEAP Guide will help national and local governments, nongovernmental organizations, and other groups working with communities identify adaptation actions to reduce the vulnerability of social, economic, and natural resources upon which communities depend.

Steps for Planned Climate Change Adaptation

The LEAP Guide is organized into four major steps to support the integration of planned adaptation within the context of existing development objectives and plans and ongoing projects and programs. Intended users include national and local governments, marine and coastal managers, disaster managers, and community development practitioners who work with coastal communities on a wide range of development issues such as food security, health, biodiversity conservation, and economic development. It is recommended that a cross-sector team be formed to facilitate and guide communities though the process. Each step is designed to be carried out with active community participation and engagement; however some activities may be more efficient if carried out in advance by this team and then presented to the community for their input and acceptance. In addition, some activities may require input from technical experts from different disciplines.

Understanding and defining climate threats in a community and assessing vulnerability to these threats are themselves early actions that support planned adaptation. This knowledge of climate threats and vulnerability is used to identify adaptation actions that can be implemented by the community. The planning process is designed to help communities, through a series of activities and exercises, develop a Local Early Action Plan (LEAP) that identifies activities that can help to reduce the impacts of climate change on their natural and social resources. The LEAP is intended to be a simple document that serves as a stand-alone plan or that can be incorporated into other plans.

Steps for planned climate change adaptation

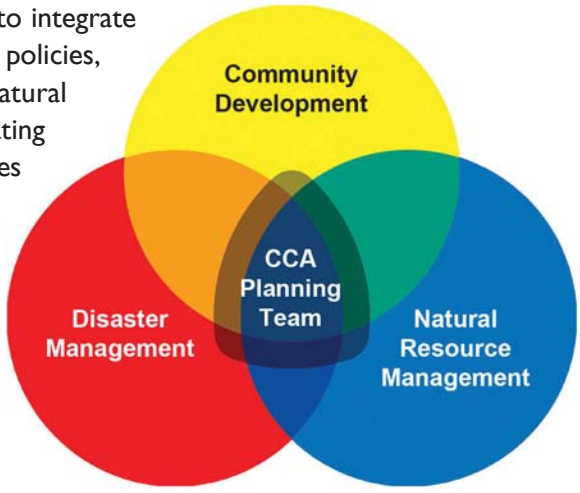
Each step in this process is designed to build upon the previous step. However, each step can also serve as a stand-alone set of activities depending on the stage and needs of the community. For this reason, you will find that concepts and terms may be repeated as needed in each step so that the facilitator does not need to refer to a previous step. Each step contains

- a description of the purpose of the step and examples of key outputs;
- a summary of key concepts and terms;
- highlights and examples of each step showcasing Coral Triangle communities; and
- a process and worksheets to guide implementation of the step.

An overview of each step is provided below.

Step One: Getting Organized for CCA Planning

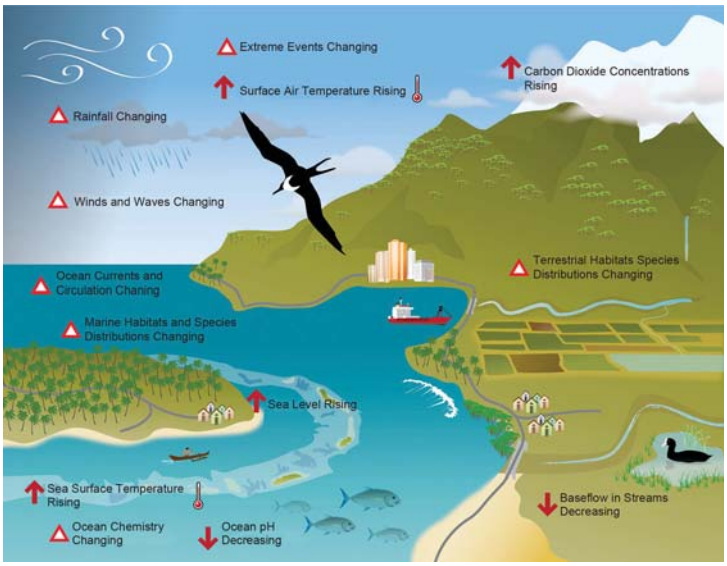
Planned adaptation requires integrated strategies with multiple sectors working together to identify gaps and opportunities to integrate climate adaptation into existing plans, programs, and policies, as well as ongoing community development and natural resource management efforts. Identifying and integrating local early actions to address climate adaptation requires a collaborative approach bringing together technical expertise and local knowledge. The guidance provided in this step helps users identify existing and new team members needed to address climate change and lead the community through the LEAP process. It also ensures that the team has the appropriate information, authority, and resources to complete the process. The output of this step is an organized CCA Planning Team with roles and responsibilities that can support community-based assessment and planning and a written Community Background that describes the existing context for adaptation.



Multiple sectors needed to plan for adaptation
(adapted from US IOTWS Program, 2007)

Step Two: Telling Your Climate Story

Helping communities understand climate change and its current and future implications to their lives and livelihoods is a critical step in taking local early action to address climate impacts. Coastal communities, dependent on natural resources, are keenly aware of changes occurring in their physical, ecological, and social environment. It is important to draw upon this extensive traditional and local knowledge in a community as well as the latest scientific knowledge to understand climate impacts and identify local early actions for adaptation. Both healthy and unhealthy communities will experience impacts from climate change; however, the community with healthier resources will be more resilient to climate impacts.



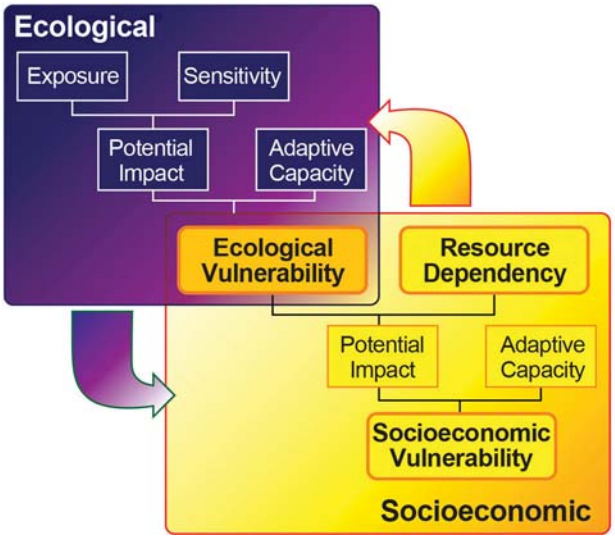
Indicators and impacts of climate change
(adapted from Arndt et al., 2009)

The activities carried out in this step will help those working with the community to communicate the basics of climate change science and identify potential impacts of climate change to priority target social and ecological resources or assets such as housing, livelihoods, mangroves, and fisheries. The community's Climate Story is developed using participatory methods to document past, present, and projected future climate change impacts based on local knowledge and the latest climate science. In addition, a methodology to conduct beach profiling and to measure the approximate extent of a 1-meter sea

level rise on land is provided in Appendix A to support the activities in this step. The output of this step is a Climate Story that summarizes past, present, and potential future climate conditions and the potential impacts to target resources about which the community is most concerned.

Step Three: Conducting a Vulnerability Assessment

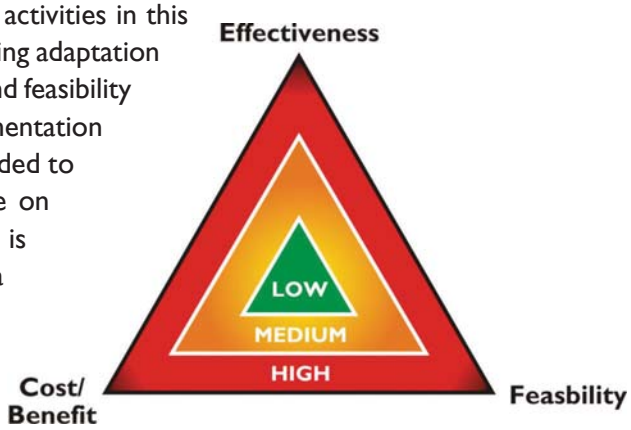
The vulnerability of a target resource is defined by the exposure, sensitivity, and adaptive capacity of that resource to climate threats. Because of the dependency of coastal communities on natural resources, the vulnerability of ecological and social systems must be assessed together. Building upon an understanding of past, present, and future climate conditions, coastal communities need to assess the vulnerability of both social and ecological resources. The activities carried out in this step will help the community conduct a qualitative vulnerability assessment of social, economic, ecological, and infrastructural target resources. In addition, the results of this type of vulnerability assessment can serve as a screening tool for specific target resources that may require a more quantitative approach to identify their vulnerability to climate change impacts as well as provide valuable information for regional and even national level planning and programming. The output of this step is a Vulnerability Assessment that helps communities understand core reasons for vulnerability to climate change impacts, which will enable them to identify actions to most effectively address those impacts.



Link between social and ecological vulnerability (adapted from Marshall et al., 2010)

Step Four: Developing Your Local Early Action Plan

Identifying effective and feasible local early actions that can be implemented to build community resilience and reduce risks from climate change is the last step of the LEAP Guide. The activities carried out through this step will help the community identify and prioritize adaptation options. Adaptation options are identified considering ecological, social, and governance benefits and potential implementation challenges. Potential adaptation options identified in the REAP-CCA (CTI-CFF, 2011) and other relevant sources are described in Appendix B to support activities in this step. This step also provides guidance on prioritizing adaptation options based on the effectiveness, cost/benefit, and feasibility to implement the action and developing an implementation schedule that defines the timing and partners needed to implement priority adaptation actions. Guidance on developing a monitoring and evaluation approach is provided in this step and supported by a benchmarking system to monitor implementation progress (see Appendix C). The outputs from all steps are combined to develop a LEAP. All the worksheets to conduct the LEAP process are provided in Appendix D.



Prioritization of adaptation actions for early action

Making Adjustments to the Process

Many communities may have already completed some or many of these steps for other planning processes. If your community has completed any of these steps or similar steps, be sure to gather this information and utilize it for this process. You may find it helpful to update materials such as community maps that were generated during previous planning processes. For example, if you only need to carry out awareness, you can carry out Step Two only. Or if your community has already been through participatory and learning activities (mapping) or a resource management planning process (such as problem/solution tree), information and products from those activities can be used to support this process. The CCA Planning Team should collect and review the information from earlier planning efforts as a foundation for the exercises in this guide before starting to work with the community. In some cases, you might need to collect additional information; in other cases, you may find that you already have enough information and can skip an exercise instead of repeating it.

The CCA Planning Team will likely identify technical actions that a community cannot pursue by itself. We highly recommend seeking expert advice before tackling any technical actions such as enhancing shoreline protection through any physical structures. This guide does not provide advice on these issues but focuses on supporting communities to start to do the early actions they are able to do.

Participants at the "Preparing for a Changing Climate Workshop" in Pohnpei, Micronesia work through a participatory vulnerability assessment.

Community Experience: Micronesia

In 2010, the Micronesia Conservation Trust (MCT) and partners supported the development of community-based climate adaptation tools for Micronesia. They engaged stakeholders to assist in producing culturally appropriate community outreach materials and to revise existing community-based planning processes and initiatives to include climate change considerations. The outcomes of this process, *Adapting to a Changing Climate Outreach Toolkit* and *Management and Adaptation Planning Guide for Natural Resource Managers,* were presented to participants of the CTI-CFF Second Regional Exchange on Climate Change Adaptation: Tools for Action in Honiara in early 2011 as examples of tools being used successfully by communities to adapt to climate change. Given the similar need for a community-based process in the Coral Triangle region and the desire to learn from the Micronesian experience, MCT graciously agreed to allow the US CTI Support Program to adapt the tools for the Coral Triangle. The LEAP Guide is the result of building on the foundation of the MCT tools and

Workshop participants discuss community outreach on climate change and its impacts.

working with communities in the Coral Triangle to adapt the tools for this region. We encourage every community who wants to use this guide to make it their own, using all or portions of the steps to fulfill their needs and to complement the planning processes in which their community is already engaged. (Case study provided courtesy of MCT.)

Community Experience: Philippines

It was agreed during the 2nd CTI Regional Climate Change Adaptation (CCA) Training held in Tagaytay City in February 2012 that the entire province of Batangas would undertake a CCA Planning Workshop with the support of the newly formed pool of CCA trainers for the Verde Island Passage (VIP). Members of the VIP CCA Team are from the Provincial Government Environment Office of Batangas, regional office of the Department of Environment and Natural Resources, Philippine Business for the Environment (representing the National Climate Change Commission), Conservation International (CI)-Philippines and PATH Foundation Inc. (PFPI). With support from the Provincial Government and municipalities of Batangas, as well as technical support from CI through the CTSP, CCA planning was completed in 10 of 15 coastal municipalities of the province in April 2013. Through the CCA Planning workshop, using the LEAP Guide in concert with the Philippine Vulnerability Assessment Tools for Coastal Ecosystems, coastal communities were better informed on the basics of climate change, the level of vulnerability of the community to the effects of climate change, and the necessary steps to address these effects. By early June 2013, the outcomes of the municipality CCA planning workshops will be rolled up into the provincial-level CCA planning, which will highlight the significance of mangrove conservation and rehabilitation as a major CCA strategy. The resulting provincial plan will be made part of the provincial comprehensive development plan in 2014, particularly in the disaster risk reduction and CCA section. (Case study provided courtesy of Evangeline Miclat CI-Philippines)

Developing local climate change stories for (a) Calatagan, and (b) Nasugbu and Lian, Batangas, Philippines.

STEP ONE


1
2
3
4
Getting Organized for CCA Planning
Telling Your Climate Story
Conducting a Vulnerability Assessment
Developing Your Local Early Action Plan

Step One: Getting Organized For CCA Planning

BEACH EROSION AT NJARI ISLAND, SOLOMON ISLANDS © ASUNCION SIA

Purpose

Climate change will dramatically affect coastal communities and ecosystems in the Coral Triangle. Changes in precipitation patterns will affect agriculture. Changes in ocean circulation and ocean chemistry will affect marine productivity and the distribution of marine life. Severe storms and coastal flooding will displace communities, damage infrastructure, and affect livelihoods. Planned adaptation requires integrated strategies with multiple sectors working together to identify gaps and opportunities to integrate climate adaptation into existing plans, programs, policies, ongoing community development, and coastal management efforts. Planning for climate adaptation will require a planning team committed to the process and team members with the authority, specialized expertise, and resources to take action. Step One will help you get organized for climate adaptation planning.

Concepts and Terms

Climate Story: The summary of past, present, and potential future climate conditions and their potential impacts on target resources that are important to a community. The Climate Story is developed based on both community-based and scientific observations of climate change and its potential impact on target resources.

Local Early Action Plan (LEAP): A summary of the outputs of the four steps described in this guide. It includes a profile of the community, a Climate Story, an assessment of the vulnerability of target resources, and priority adaptation actions that a community wants to take to reduce its vulnerability to climate change. The LEAP can serve as a stand-alone document that can be used to support budget requests, or parts of it can be integrated into existing plans.

CCA Planning Team: The CCA Planning Team should include those individuals committed to facilitating the climate change adaption planning process and completing the associated documents. Specialized technical experts and partners from different sectors may be needed at different steps in the process (Figure 1.1). Depending on the target resources of concern to the community, technical expertise may be needed that supports the following areas:

- **community development** sectors including social services, transportation, economic development, agriculture;
- **natural resource management** sectors including forest management, land-use management, and coastal resource and fisheries management; and
- **disaster management** sectors including climate and hazard early warning, hazard mitigation, emergency response, and disaster recovery.

Figure 1.1 Multiple sectors are needed to plan for adaptation (adapted from US IOTWS, 2007).

Target Resource: The social and ecological assets of the community. Social assets may include people, homes, schools, hospitals, roads, businesses, and livelihoods. Ecological assets may include rivers, sand dunes, wetlands, estuaries, mangroves, coral reefs, and fish. Target resources are the focus of vulnerability assessments and adaptation planning.

Vulnerability Assessment: An evaluation of the exposure, sensitivity, and adaptive capacity of a target resource to climate threats. It serves to inform adaptation planning.

Overview of Activities

The output of this step is an Organized CCA Planning Team composed of individuals representing multiple sectors that have reviewed and have become familiar with the four adaptation planning steps and a Community Background section that highlights priority threats for the LEAP. Step 1 is organized into the following activities:

Identify team members to support adaptation planning (Activity 1.1). This activity is completed with the CCA Planning Team and involves identifying team members, technical expertise, and partners from different sectors who may be involved in planning for climate adaptation. This CCA Planning Team will work with the community and facilitate the LEAP process.

Collect background information about your community (Activity 1.2). This activity will help the CCA Planning Team understand the context for adaptation planning and identify existing community issues and priorities. An understanding of priority concerns can provide an entry point for adaptation planning. The output of this activity, Community Background, forms the first section of the LEAP.

Complete the "Getting Organized Checklist" (Activity 1.3). This activity is completed with the CCA Planning Team and will help to make sure that (a) appropriate authorities are aware of and support the outreach and planning process, and (b) the CCA Planning Team is organized and ready to facilitate the process.

Review the LEAP outline (Activity 1.4). This exercise will familiarize the CCA Planning Team with the structure of a LEAP and how each step in the planning process supports the completion of the final document.

Community Experience: Solomon Islands

Getting organized for local early action planning in the Solomon Islands involved selecting focus sites and gathering existing materials and information about those sites (Abernethy et al., 2012). A number of participatory rural appraisals were available for these villages, as they had experienced a large earthquake and tsunami that significantly changed the landscape and moved many people upland from the coast.The CCA Planning Team conducted scoping visits that included walks through the village with community leaders and other community members. During these visits, the team asked community members about their resource use and dependency, and about changes that had occurred as a result of the tsunami. The team determined that, at the community level, reading, writing, and following instructions would require some expert guidance either from champions within the community or from an external

facilitator. Working with the community leaders, the team developed a workshop-planning schedule and sought permission to carry out climate change awareness evenings with the selected communities. (Case study provided courtesy of Kirsten Abernethy of WorldFish)

Activity 1.1 Identify Team Members to Support Adaptation Planning

A CCA Planning Team should be developed before you start planning with the whole community. The CCA team will be committed to facilitating the process and completing the associated documents (for example, writing the Climate Story in Step Two and the LEAP in Step Four). In addition, planning for adaptation may require specialized technical expertise, sector-specific knowledge, and partners. In order to identify potential team members to add to the CCA team or provide specialized expertise, use Worksheet 1-1 to identify opportunities for integrating climate adaptation into existing policies, plans, programs, and projects in the community. Using this list, identify potential team members and their roles in the planning process. Then reach out to these potential team members and discuss their interest in participating in the planning process.

Worksheet 1-1: CCA Team Members to Support Planning

Existing Policies, Plans, Programs, Projects in the Community	Opportunities for Integrating Climate Adaptation	Potential Team Members and Role
Community Development (population centers, health care, hospitals, schools, transportation, drinking water wells, roads, ports, tourism, aquaculture, agriculture, fishing infrastructure)		
Natural Resource Management (water quality and quantity; coastal and fisheries resources including habitats such as rivers, wetlands, estuaries, mangroves, seagrass, coral reefs)		
Disaster Management (hazard detection, early warning, disaster mitigation, disaster response, and recovery)		

Activity 1.2 Collect Community Background Information

The CCA Planning Team should summarize initial background information about the community to help set the context for adaptation planning and identify existing community issues and priorities. Use Worksheet 1-2 to collect Community Background information. This background will help the team begin to identify target social and ecological resources of concern to the community and additional expertise you may need to include on the CCA Planning Team to work through the adaptation planning steps. The Community Background is incorporated into the first section of the LEAP (see Table1.1).

Worksheet 1-2: Community Background Information

Question	Answer
Where is your community located?	
About how many people live in your community?	
What are the major occupations (income-generating and subsistence activities) of community members?	
What are the main stakeholder groups in your community?	
How are decisions made in your community? Who has authority?	
What social groups are currently active and what purpose do they serve?	
What are the main strengths of your community?	
What aspects of natural resource management are in place and working well?	
What aspects of social infrastructure (schools, roads, health care, etc.) are in place and working well?	
Please explain 1 to 3 priority natural resource threats or problems your community is facing. Provide details.	
Please explain 1 to 3 priority social threats or problems your community is facing. Provide details.	
What community initiatives are underway or planned (e.g., drinking water, sanitation, transportation, housing, fisheries, agriculture, forestry)?	
What are the priority development objectives of the community (e.g., improve drinking water, diversify livelihoods, improve fish catch)?	

Activity 1.3 Complete the "Getting Organized Checklist"

The CCA team should have the skills, time, and commitment to complete the adaptation planning process. To make sure the team is organized and prepared to be successful, review the statements in Worksheet 1-3. Check the boxes for all activities that apply to your situation and then fill in the associated descriptions. It is recommended that all of the "Getting Organized" activities at least be discussed and ideally be completed before moving forward. After reviewing the statements in the checklist, the team should decide if it is prepared with the right information and if now is the right time to initiate awareness-raising and the development of a LEAP or if it needs to carry out additional activities before the team is ready to start the planning process.

Worksheet 1-3: Getting Organized Checklist

Question	Answer
☐ A CCA Planning Team has been identified that is capable of and committed to facilitating the planning process.	*List team members and their roles:*
☐ Priority development objectives of the community have been identified.	*List objectives:*
☐ Geographic boundaries of the planning area have been defined.	*Describe the area's boundaries:*
☐ Opportunities to integrate climate adaptation into existing policies, plans, programs, and projects that support priority development objectives in the community have been identified.	*The existing plan(s) are:*
☐ Leaders in the community understand the reasons for adaptation and want to plan for it.	*Explain why community leaders want to do a LEAP:*
☐ Local leaders, experts, and partners covering multiple sectors have been identified to support planning efforts.	*List additional team members and their roles in awareness-raising and/or planning:*
☐ Key stakeholder groups have been identified and understand how they will be engaged in the planning process.	*List stakeholder groups:*
☐ Community is ready to engage in the planning process.	*Please explain:*
☐ Individuals/agencies with the authority to make management decisions for the area and to adopt the final plan have been engaged.	*Please explain:*
☐ Existing information about the area (e.g., community initiatives, maps, historical photos, social or biological studies, information on climate) has been compiled.	*Information includes:*
☐ A target date for finishing the planning process has been established.	*Target date for completion of the LEAP:*
☐ Sufficient time and financial resources to complete the planning process have been committed by the team.	*List financial sources and agreed-upon time allowance:*

Activity 1.4 Review the LEAP Outline

If your CCA Planning Team is planning to carry out all of the steps in this guide to develop a LEAP, it is recommended that you first review the LEAP outline to understand what contents will comprise the complete document (Table 1.1). Different sections of the template can be filled in after finishing different steps in the process; at the end of Step Four, the team has developed a LEAP.

The LEAP can be used to guide actions to improve the health of the community's resources, reduce non-climate threats, and reduce the vulnerability of a community to climate change. This plan is designed in a way to make it easy for planning teams to seek support from funders and resources agencies. If the community already has existing plans, they can take any new activities or objectives from the LEAP and integrate these into associated plans.

Table 1.1 Local Early Action Plan Outline

1. **Community Background** (Output of Step One)
   Summary Description (location, population size and characteristics, social and ecological resources and threats)

2. **Climate Story** (Output of Step Two)
   Community Map
   Historical Timeline
   Seasonal Calendar
   Indicators of a Changing Climate
   Target Resources and Status

3. **Vulnerability Assessment** (Output of Step Three)
   Vulnerability Assessment Summary for All Target Resources

4. **Priority Adaptation Actions and Implementation Schedule** (Output of Step Four)

Priority Adaptation Actions and Implementation Schedule				
Target Resource	Priority Action	Timeframe	Lead and Partners	Resources or Support Needed

5. **Monitoring and Evaluation Approach** (Output of Step Four)
   Indicators (baseline data, monitoring approach)

Appendices:
- Vulnerability Assessment Matrix by Target Resource (Target-specific outputs from Step Three)
- Adaptation Options Matrix by Target Resource (Target-specific outputs from Step Four)

STEP TWO


1
2
3
4
Getting Organized for CCA Planning
Telling Your Climate Story
Conducting a Vulnerability Assessment
Developing Your Local Early Action Plan

Step Two: Telling Your Climate Story

WAKATOBI VILLAGE, INDONESIA © STACEY TIGHE

Purpose

Helping communities understand climate change and its effects on their lives and livelihoods is a critical first step in taking local early action to address climate impacts. Coastal communities, dependent on natural resources, are keenly aware of changes occurring in their physical, ecological, and social environment. It is important to draw upon this extensive traditional and local knowledge in a community as well as the latest scientific knowledge to understand climate impacts and identify local early actions for adaptation.

Concepts and Terms

Climate: The weather averaged over a long period of time, typically 30 years or more (IPCC, 2001).

Climate Change: A change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/or the variability of its properties that persist for an extended period, typically decades or longer (IPCC, 2001).

Climate Story: The summary of past, present, and potential future climate conditions and their potential impacts on target resources that are important to a community. The Climate Story is developed based on both community-based and scientific observations of climate change and its potential impact on target resources.

Climate Threats: The overall change in environmental conditions (e.g., increasing sea surface temperature) resulting from changes in climate due to increasing global greenhouse gas concentrations.

Climate Variability: The variations in the mean state and other statistics (e.g., standard deviations, the occurrence of extremes) of the climate on all spatial and temporal scales beyond that of individual weather events. Examples of climate variability include interannual El Niño and La Niña events that occur every two to seven years and influence weather patterns over vast regions of the globe (IPCC, 2001).

Ocean Acidification: Ocean acidification occurs when carbon dioxide in the atmosphere reacts with water to create carbonic acid, decreasing both ocean pH and the concentration of the carbonate ion, which is essential for calcification by marine organisms such as corals (Kleypas et al., 2006).

Resilience: Resilience is the ability of an ecosystem to maintain key functions and processes in the face of human or natural stresses or pressures, either by resisting or adapting to change (Nystrom & Folke, 2001). This concept applies to both ecological and social capacity to cope with, adjust to, and recover from external stresses and disturbances such as those brought on by climate change. It is the flip side of vulnerability. Therefore, if you increase the resilience of a community or resources, you will decrease their vulnerability.

Target Resources: The social and ecological assets of the community. Social assets may include people, homes, schools, hospitals, roads, businesses, and livelihoods. Ecological assets may include rivers, sand dunes, wetlands, estuaries, mangroves, coral reefs, and fish. Target resources are the focus of vulnerability assessments and adaptation planning.

Vulnerability: The degree to which a human or natural system is susceptible to or unable to cope with adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and the variation to which a system is exposed, its sensitivity, and its adaptive capacity (IPCC, 2001).

Weather: The atmospheric conditions at a particular place in terms of air temperature, pressure, humidity, wind speed, and rainfall. Weather is what is happening now or is likely to happen in the very near future. You can observe the weather by looking outside to see if it is raining, windy, sunny, or cloudy. You can tell how hot or cold it is by looking at a thermometer.

Overview of Activities

The output of this step is a Climate Story. This step is aimed at providing the community with the information needed to understand climate change and current and potential impacts. It also provides a key opportunity to gather information from community members on the changes in climate and the impacts they are experiencing and to combine this information with the latest scientific projections of climate change to inform the vulnerability assessment. While climate change is a global issue, its impacts are felt locally. The combination of the global scientific information and the local context is essential to developing successful adaptation options. Step Two is organized into the following activities:

Map the community (Activity 2.1). This activity will help the CCA Planning Team and community members to visualize the community and identify target resources that have been affected by climate change threats or natural hazards in the past and which might be exposed to future events. The Community Map will be used again in Activity 2.5 and in Step Three Conducting a Vulnerability Assessment.

Describe past climate conditions (Activity 2.2). In this activity, community members will create a timeline by recording major climate and weather-related events (droughts, floods, coral bleaching, crop failures, etc.) and natural hazard events (earthquakes, tsunamis, etc.) of the last 50 years. The community may also consider recording major social events such as political events on the timeline. This information and the related discussions will help the community think about what events have impacted them in the past, any trends they see (e.g., events that are getting more frequent or worse), and their ability to cope with past impacts.

Describe current climate conditions (Activity 2.3). In this activity, community members will develop a seasonal calendar of what they would have considered a "normal" year with respect to wet versus dry seasons, and activities such as planting, harvesting, fish spawning, etc. Then they will describe any changes to the "normal" timing of these events in order to better understand how climate change currently may be affecting them.

Describe future climate conditions (Activity 2.4). Each day, our scientific understanding of future changes we may expect to things like air and sea temperatures, and the impacts those changes will have, grows. The purpose of this activity is to examine the latest climate science and projections for the region to better understand the impacts that the community may face to its ecological and social resources in order to adapt to climate change. It is helpful to consult experts from a local university or government agencies for this activity. If that is not an option, technical resources are available to assist you.

Identify ecological and social target resources (Activity 2.5). In this activity, the CCA Planning Team and the community will use the Community Map (Activity 2.1) and Community Background Information (Activity 1.2) to identify and describe priority ecological and social resources of greatest importance to the community. In determining these priorities, the team should consider the level of dependency of the community on that resource and how a particular resource might be linked to and affect other resources. In this activity, you will also summarize the current condition of the target resource and the potential impacts of climate change to the resource. These target resources will become the focus of the Vulnerability Assessment in Step Three. An example of description of target resources in provided in Table 2.1.

Complete the Climate Story (Activity 2.6). In this activity, the CCA Planning Team will work with the community members to write a "story" about the community, explaining which climate threats they are most concerned about and why. Information from this activity can be added directly to the LEAP template. An example of a completed Climate Story, based on training exercises conducted for the Western Province, Solomon Islands, is provided in Table 2.2.

Table 2.1 Example Description of Ecological and Social Target Resources

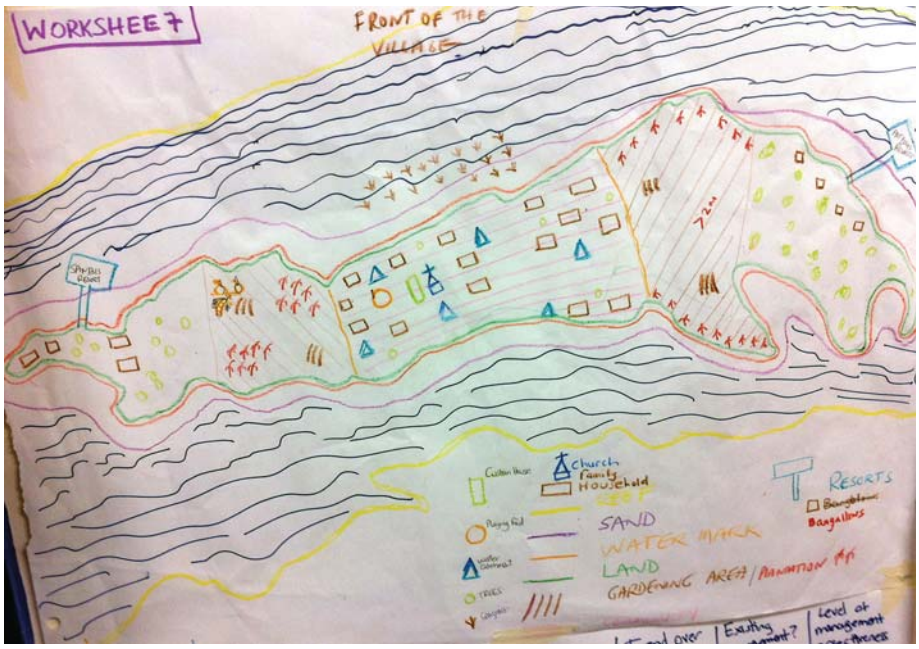
	ECOLOGICAL AND SOCIAL TARGET RESOURCES			
Priority Resource Targets	Resource Dependency	Resource Condition	Resource Linkages	Potential Climate Impacts to Target Resources
	What is the importance of this resource to the community (high, medium, or low), and why?	*What is the condition of this resource, and is it getting better, worse, or staying the same?*	*How does the condition of this resource affect other ecological and social target resources?*	*What are the potential impacts of climate change to target resources?*
Ecological Targets				
1. Coral Reefs	High – Community is dependent on reef for food security and as the draw for the dive tourism industry that provides jobs and supports small business in the area.	Coral reefs in the area are in good condition but declining because of sedimentation from increasing deforestation in the watershed and anchor damage from dive tourism industry. Destructive fishing practices have been an issue in the past, but the community has successfully been addressing this issue.	Food security (subsistence fisheries) and dive tourism & associated local businesses depend on a healthy coral reef. In addition, the shoreline protection (dampening of storm surges and waves) is important to reduce beach erosion and damage to coastal infrastructure (homes, roads, businesses, church, and hospital).	More severe rainfall events creating more surface water runoff and sedimentation Increased sea-surface temperature and coral bleaching Ocean acidification
2. Reef Fish	High – The community is dependent on reef fish as its primary source of protein.	Reef fisheries are in poor condition but are getting better. Destructive fishing and overfishing were an issue due to inadequate fisheries management –	Primarily the condition of the reef fisheries impacts the food security and livelihoods of the community.	Habitat destruction and degradation due to impacts of sea-surface temperature and ocean acidification to coral reefs.

Table 2.1 (*continued*)

	ECOLOGICAL AND SOCIAL TARGET RESOURCES			
Priority Resource Targets	**Resource Dependency**	**Resource Condition**	**Resource Linkages**	**Potential Climate Impacts to Target Resources**
		in particular weak enforcement of existing regulations. The community has started to take measures to address these issues.		Ocean acidification can have direct impacts to reef fisheries.
Social Targets				
3. Drinking Water (wells)	High – Drinking water wells are the sole source of water for the community and local dive tourism resorts.	Drinking water quality and quantity is in poor condition and is declining because of saltwater intrusion from overdrawing groundwater sources associated with the growth of the dive tourism industry.	Human health and the local economy are directly tied to drinking water.	More drought conditions reducing groundwater recharge and increasing saltwater intrusion Sea-level rise causing saltwater intrusion
4. Dive Tourism	Medium – The dive tourism industry is a growing source of livelihood to the community.	The local dive tourism industry is in good condition and is getting better as it has continued to grow over the last 5 years. It now provides jobs for members of the community and contributes to the growth of small businesses in the area.	Community livelihood is dependent on the dive tourism industry. Additionally, if the industry continues to grow it may provide alternative livelihoods for fisher folk and there for improve the condition of coral reef fisheries indirectly.	Severe storms causing damaging wind conditions Coastal inundation from severe storms Coastal erosion from severe storms and coastal inundation Sea-level rise causing coastal inundation

Table 2.2 Example Climate Story

COMMUNITY NAME: *Community in the Western Province, Solomon Islands*



INDICATORS OF A CHANGING CLIMATE			
	Climate Threat		Impacts
Indicator	Magnitude and direction of change over time based on community knowledge and latest climate science	Changes in environmental conditions	Potential impacts to ecological and social resources
Air temperature	*Will increase (1.0-3.0°C by 2100)*	*Warmer temperatures, shifts in seasons, changes in rainfall patterns*	*Shifts in growing seasons, leading to changes in harvest; shifts in terrestrial species distribution; impacts to food security*
Sea-surface temperature	*Generally increasing (1.0-4.0°C by 2100), though affected by local factors like upwelling*	*Warming seas, changes in currents, potentially stronger storms*	*Coral bleaching and potential loss of reef structure and associated fish; shifts in marine species distribution and migration patterns; impacts to food security*
Sea level	*Generally will increase but not uniformly (0.3-0.6 m by 2100), affected by oceanographic patterns, tectonic movement, groundwater extraction, and melting ice sheets*	*Coastal inundation and erosion*	*Damage to key infrastructure (roads, hospitals), homes, and culturally important areas; saltwater intrusion to wells and crops; coastal erosion; exacerbate impacts of storm surges and king tides to coastal communities and resources*
Rainfall patterns	*Potential for more extreme droughts and rain events*	*Potentially more floods, droughts, and extreme events; shifts in the rainy season*	*Loss of property, increased runoff of sediments and pollutants, impacts to crops and livestock, issues with freshwater availability, degrading water quality along the coast*

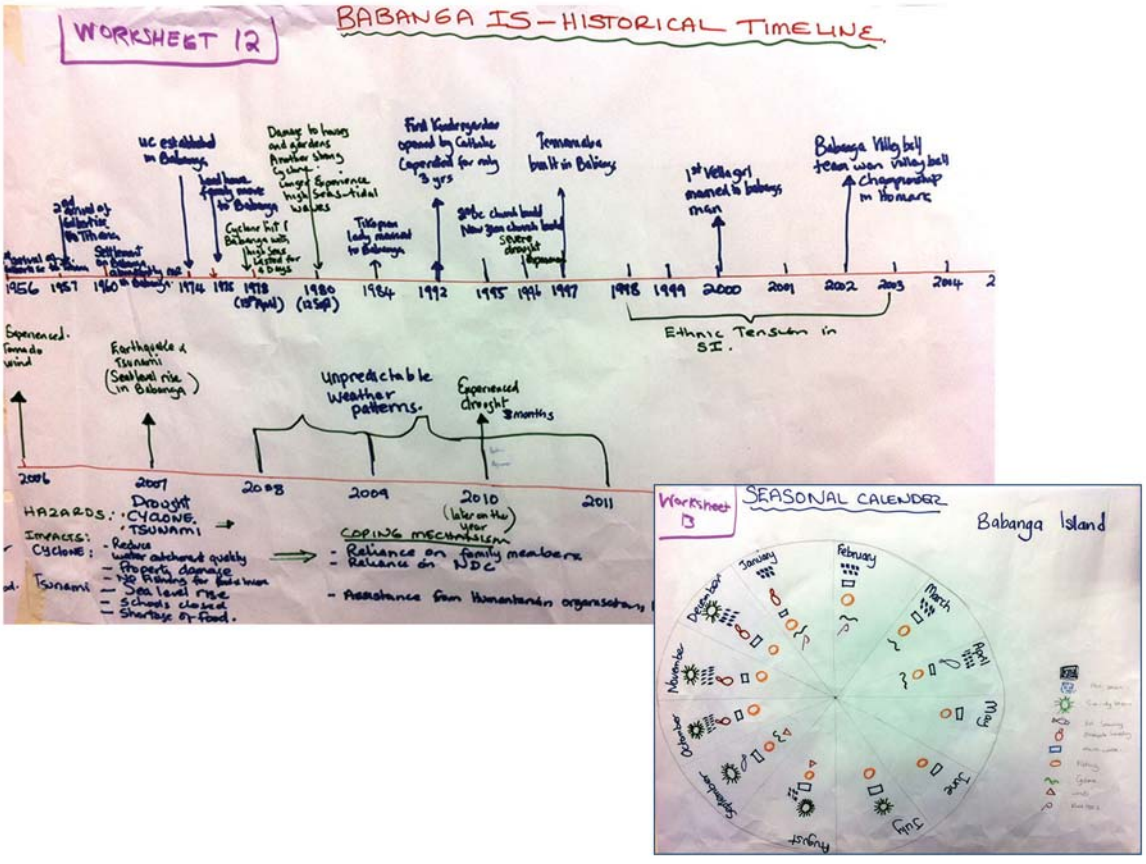
Ocean pH	*Generally decreasing and becoming more acidic but not uniformly due to local factors (benthic habitats, freshwater inputs, etc.)*	*Decreasing aragonite saturation state; less available carbonate to form skeletons (coral) and shells (shellfish, diatoms)*	*Potential slower growth of coral skeletons and shellfish; impacts to the habitat of reef fish, which families depend upon for food; potentially weaker shells*
Ocean circulation	*No consensus, but ENSO will continue to be a source of consistent climate variability*	*Potential changes in circulation, sea level, rain patterns*	*Drought; extreme rain events; king tides; changes in fresh water availability; changes in connectivity and larval movement for corals, fish, etc.*
Tropical cyclones	*No consensus*	*Potentially more intense; possible change in tracks*	*More damage caused by cyclones to community resources*

OBSERVATIONS OF PAST AND PRESENT IMPACTS: Based on historical trends, what climate events are most frequent, and which have the greatest impacts? What changes to the normal seasons is the community noticing, and what are the impacts of those changes that most concern the community? Where are these changes or hazards occurring? (Use Historical Timeline, Community Map.)

This island community has experienced a drought, cyclone, and tsunami in the past, which have caused property damage, reduction in water quality, shortage of food, closing of schools, and interruption to fishing for food and income. Storm surges have inundated the entire island, contaminating freshwater wells.

FUTURE: Based on the community's past experience and the current situation, which of the projected climate threats and impacts most concern your community, and why? (Use available scientific projections, the indicators of a changing climate, and observations from the past and present.)

This island community is most concerned with drought, sea-level rise, and increasing sea-surface temperatures, as these are all likely to increase. The community has already been impacted by these things in the past.



Community Experience: Solomon Islands

The youth and the elders in communities on Ghizo Island, Solomon Islands came together to make a film about climate change in their communities, facilitated by the WorldFish Center and WWF as part of CTSP Community-based Climate Change Adaptation program.

Top: **WorldFish staff briefing youth about tasks for the photofilm project.**
Bottom: **Youth interviewing elder from Saeraghi.**

The purpose of the doing the photo film was primarily to increase the participation of Ghizo youth from the villages of Saeraghi and Paeloge in the CCA process. This idea was brought about because there was low participation of youths in the adaptation workshops conducted in their communities and the implementation team (WorldFish and WWF) saw that there needed to be a specific activity targeted to the youth groups. Youth have not seen the changes the elders have seen, and it was envisioned that through the process of the photo film activity, the youth could increase their understanding of how things have changed. The activity they were tasked with was to take pictures of key features where changes are obvious to youth now, or based on what others in the community told them. They were also tasked with conducting interviews with elder men and women of the village, who hold memories of their community in the past, to talk about the changes they've seen and their advice for future generations.

Community leaders identified three people in each of the areas of Paeloge and Saeraghi to lead in collecting stories and pictures for the photo film. The teams comprised a male and a female youth along with an elder to mentor in the interview process. WorldFish, through the CTSP project, provided voice recorders and cameras to create the photo film, and trained the youth in how to use the equipment. The teams were given the task of collecting 200-plus pictures, and a time was agreed on for when to record interviews with the elders.

In the interviews with the elders, youth asked questions about what life was like for them in the past, and elders talked about various topics including resources use and management and compared their past use with the present. In the photo film, the youth also tell their story of their hopes and dreams are for their community in the future and what they can do now in light of the changes they've become aware of. With the help of WorldFish and WWF staff, a photo story was put together and the final product was shown to the youth and communities in awareness evenings and was also shown in one of the information booths during an Arts Festival week in Gizo town held in July 2012. (Case study provided courtesy of Zeldalyn Hilly and Anne-Maree Schwarz of WorldFish.)

Before You Begin: Understanding Climate Change

Before developing the Climate Story, the community should have an understanding of what climate change is, how it might impact the community, and what they can do about it. A series of key questions are presented here along with resources the CCA Planning Team can use to discuss climate change with the community. This is a very important step, one that you are likely already engaged in if the community has expressed an interest in developing a LEAP.

Question 1: What is the difference between "weather" and "climate"?

Weather is the atmospheric conditions at a particular place defined in terms of air temperature, pressure, humidity, wind speed, and rainfall. Weather is what is happening now, or is likely to happen tomorrow or in the very near future.

Climate is the average weather or typical conditions in a place over the last 30 years or more. Climate can be described as the conditions you expect based on your experience of past years and seasons, while weather is the actual daily conditions.

Question 2: What is climate change, and why is it happening?

Climate change is a change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/or the variability of its properties that persist for an extended period, typically decades or longer (IPCC, 2001). More simply, it is a long-term change in measures of climate – or in average patterns of temperature, rainfall, snow, or wind – lasting for decades or longer. Throughout history, the earth has warmed and cooled over very long periods of time due to natural factors such as changes in the sun's energy and natural processes within the climate system such as changes in ocean circulation. However, the earth is now warming much faster than ever before due to human activities such as the burning of fossil fuels to provide electricity and transportation (cars, trains, planes, etc.) and deforestation, which releases greenhouse gases like carbon dioxide into the atmosphere. Greenhouse gases form the earth's atmosphere and naturally act like a blanket around the earth to trap the sun's heat, which regulates the temperature. But the extra greenhouse gases released by human activities are causing that blanket to get thicker and trap more and more heat, which is causing the Earth's temperature to rise. Scientists predict that the earth's average temperature will increase between 2° to 4.6°C in the next 100 years. This amount of temperature change will create shifts in normal climate patterns all over the world. When considering the impacts of climate change on a community, it is important to consider both climate variability (those shorter-term extreme events that a community will have to deal with seasonally or annually) and climate change (those slower, progressive changes over time that may not be as evident).

Question 3: What is climate variability?

The earth's climate does not stay the same all the time, even in a particular place. Climate varies naturally on seasonal, decadal, centennial, and even longer time cycles. This can lead to conditions that are hotter or colder, wetter or drier, more stormy or calmer than average. This difference is known as "climate variability," and it applies to scales of time and space that are greater than one single weather event. The increase in temperature, in addition to these other variations, can be seen as a trend which is due to climate change. One of the most well-known examples of natural climate variability is the El Niño Southern Oscillation (ENSO), an interaction between the ocean and the atmosphere over the tropical Pacific Ocean which causes El Niño and La Niña conditions. These different conditions involve changes in sea-surface temperatures, rainfall, air pressure, and atmospheric circulation. Weather all

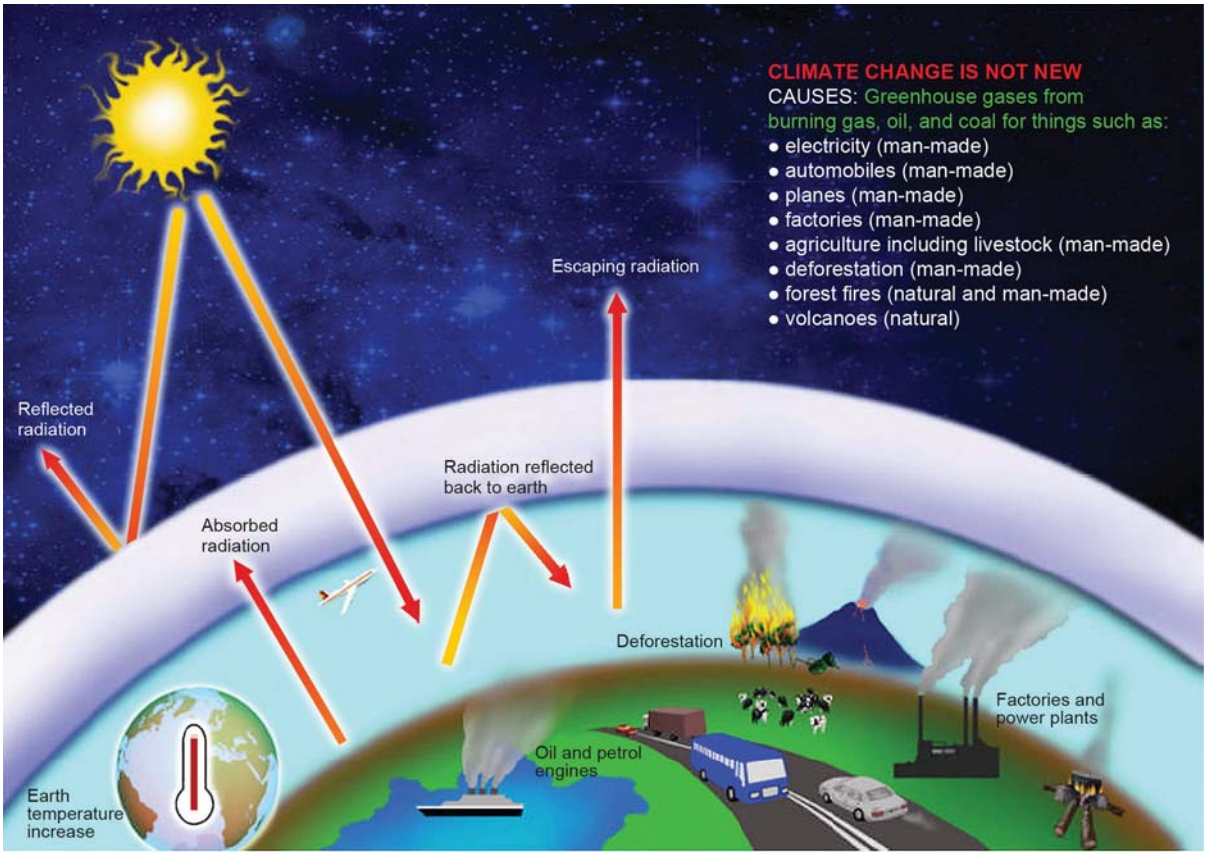


Figure 2.1 Illustration of the greenhouse gas effect and sources of additional greenhouse gases to the atmosphere (adapted from Gombos et al., 2010).

over the world is affected, and droughts, heavy rains, and king tides can impact the Pacific Islands and the Coral Triangle Region. El Niño, characterized by warmer-than-normal sea-surface temperatures, always happens first and lasts for about one year. It is followed by La Niña, the cooler phase, which may last for two or more years. Usually, the cycle between El Niño and La Niña happens every three to seven years, with more "normal" weather patterns in between. Climate variability is experienced as extreme events. As the climate changes, these events may be worse than they were in the past.

Question 4: What changes and impacts will we likely see from climate change?

The average air temperature will increase as the earth becomes hotter. This will cause shifts in normal weather and rainfall patterns. For example, some areas may become drier, while others may become wetter. The average temperature of the sea surface will increase, which may cause coral bleaching and changes in fish distribution. Sea level will rise in many locations due to a combination of the melting of land ice in Antarctica and other areas and the expansion of ocean waters as they warm. As the level of the sea rises, this may impact the coastline and increase the intensity of storm surges. Weather patterns including storms, drought, rainy seasons, and dry seasons will change in different ways in different places and may result in more extreme events. In general, seasons will become less predictable, and extreme weather events will become more common. We don't know exactly how climate change will affect patterns like El Niño and La Niña (described in question 3), but scientists predict they may become more frequent. Fortunately, scientists have become adept at predicting when El Niño and La Niña are likely to occur, thus giving communities time to prepare – for example, to store water and food when El Niño is predicted and to secure homes and crops and store food when La Niña is

predicted. These impacts will in turn have ecological, social, and economic impacts, as they will affect things like livelihoods, infrastructure and cultural resources. Figure 2.2 shows some indicators of climate change. Up arrows indicate a change in the positive direction (higher, more), and down arrows indicate an average change in the negative direction (lower, less). The delta sign (△) indicates that the change could increase or decrease depending on the location.

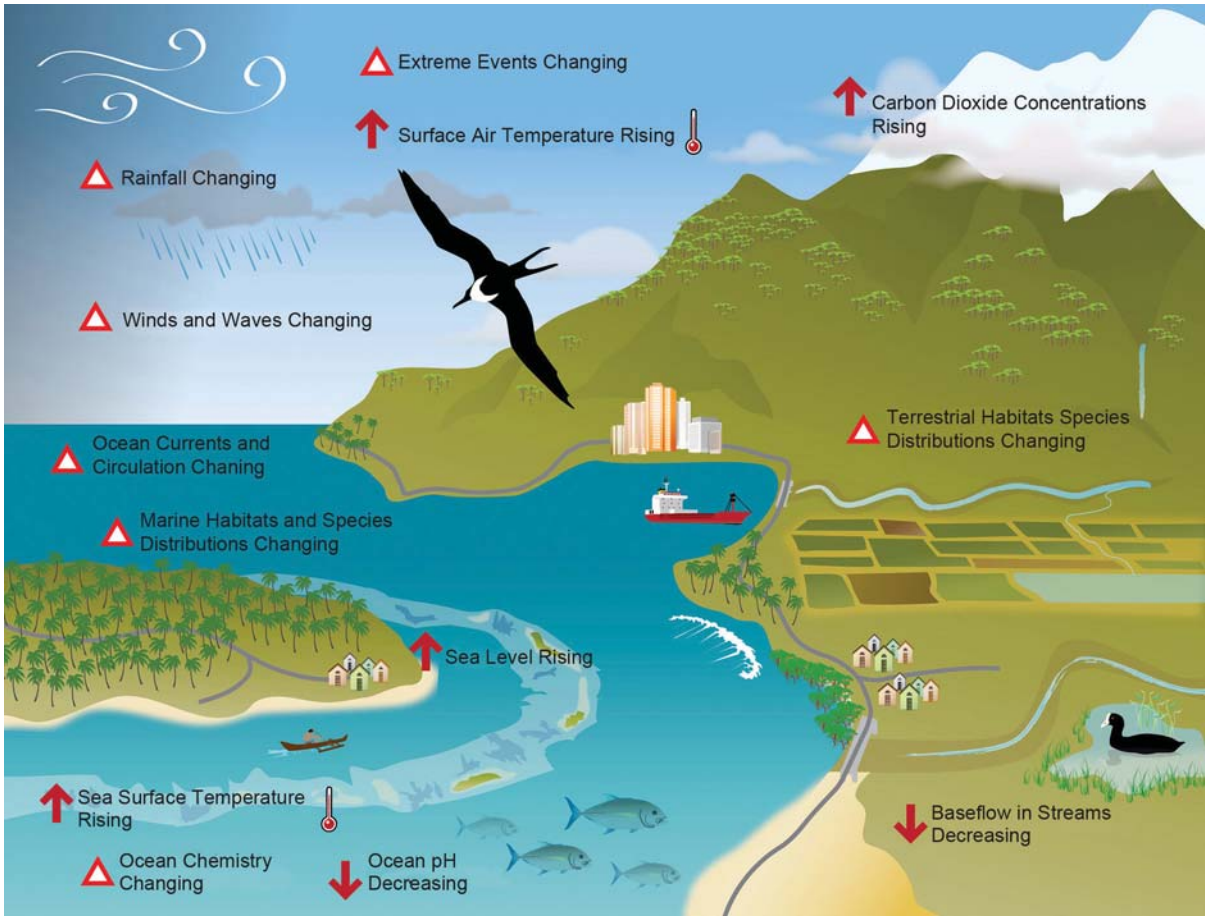


Figure 2.2 Indicators of climate change (adapted from Arndt et al., 2010).

Coastal communities are already noticing impacts from climate change, including these:

- Flooding during king tides from sea-level rise that can damage the coastline and buildings;
- Coastal erosion from sea-level rise combined with king tides and storm surges;
- Salt water intruding into wells and fields and extreme high tides due to sea-level rise and king tides;
- Water shortages from longer dry seasons;
- Changes in fish species and possible decreases in local fish populations and catch as some fish move to deeper, cooler water as the sea gets hotter (the impact to a community can increase if overfishing is already occurring);
- Crop failures from long dry seasons or too much rain;
- Changes in fruiting and growing seasons for key crops; and
- Bleaching of coral reefs with the increase in sea-surface temperature, threatening local fisheries.

It is also important to note that climate change may interact with non-climate threats to increase these impacts. For example, if beach erosion is occurring due to a poorly placed seawall, sea-level rise may exacerbate the erosion. As another example, if coral reefs are already unhealthy due to run-off of sediments and nutrients from agricultural fields, they may not be able to recover from a bleaching event caused by increased sea-surface temperature.

Through the exercises and process of developing a Climate Story, the community can talk about these changes and how they have dealt with them in the past as the basis of reducing their vulnerability in the future.

Question 5: How will climate change affect a healthy community and unhealthy community differently?

Both healthy and unhealthy communities will experience impacts from climate change (Figures 2.3 and 2.4). For example, as air temperature rises, plants may become stressed in both communities. As sea temperatures rise, both communities may experience coral bleaching. As sea level rises and storms become more severe, both communities will experience storm surge. However, the community with healthier resources will be able to either withstand or recover from these impacts more successfully. This healthy community or ecosystem is therefore more resilient to climate impacts. For example, corals in the healthy community may survive coral bleaching because the water quality is good and there is low sedimentation due to the community's agricultural practices; corals in the unhealthy community, with poor water quality and sediment flowing into the coastal waters, were already stressed before the bleaching event, so less coral survived. The unhealthy community is more vulnerable to the impacts of climate change because the social and natural resources are already weakened. Having healthy resources does not guarantee that these resources will survive the impacts of climate change; however, it increases chances that the resources can withstand or recover from impacts, thus helping to protect and provide benefits to the community in the long term.

Question 6: What can we do to reduce the impacts of climate change?

There are many things a community can do to improve the health of its natural and social resources and reduce the impacts of climate change (Figure 2.5). By using the activities in this guide to gather information on the past, present, and potential impacts of climate change to inform a Vulnerability Assessment, the community is taking the first major step. By identifying the most vulnerable resources and people in the community, actions can be taken to reduce vulnerability. Key actions a community might consider, based on the information from its Vulnerability Assessment, include these:

- Planting mangroves and other native shoreline plants that help to reduce coastal erosion and buffer the impacts of storm waves and rising sea levels. Mangrove planting is recommended only in areas that had mangroves in the past.
- Maintaining and/or reforesting upland vegetation can help to protect hillsides; help to secure the freshwater supply by retaining water in the forest; and reduce flooding, landslides, and sedimentation in times of severe storms.
- Building water catchments to store water for severe droughts and fixing leaky pipes to existing water tanks help to ensure that available rainwater is being captured for use.
- Planting crops away from seawater inundation areas and using species that are drought-tolerant can protect crops. When planting next to the coast is necessary, use species that are salt-tolerant.

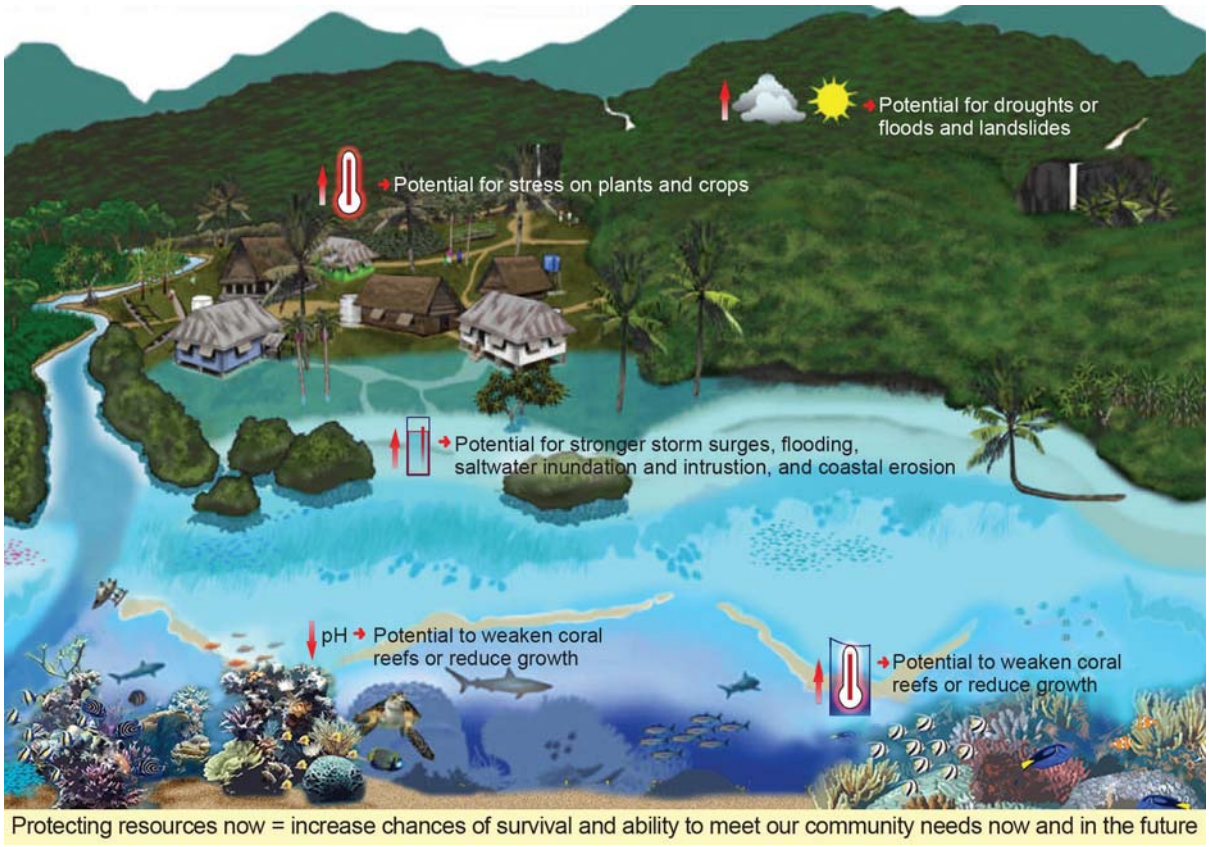


Figure 2.3 Changes to a healthy community (adapted from Gombos et al., 2010).

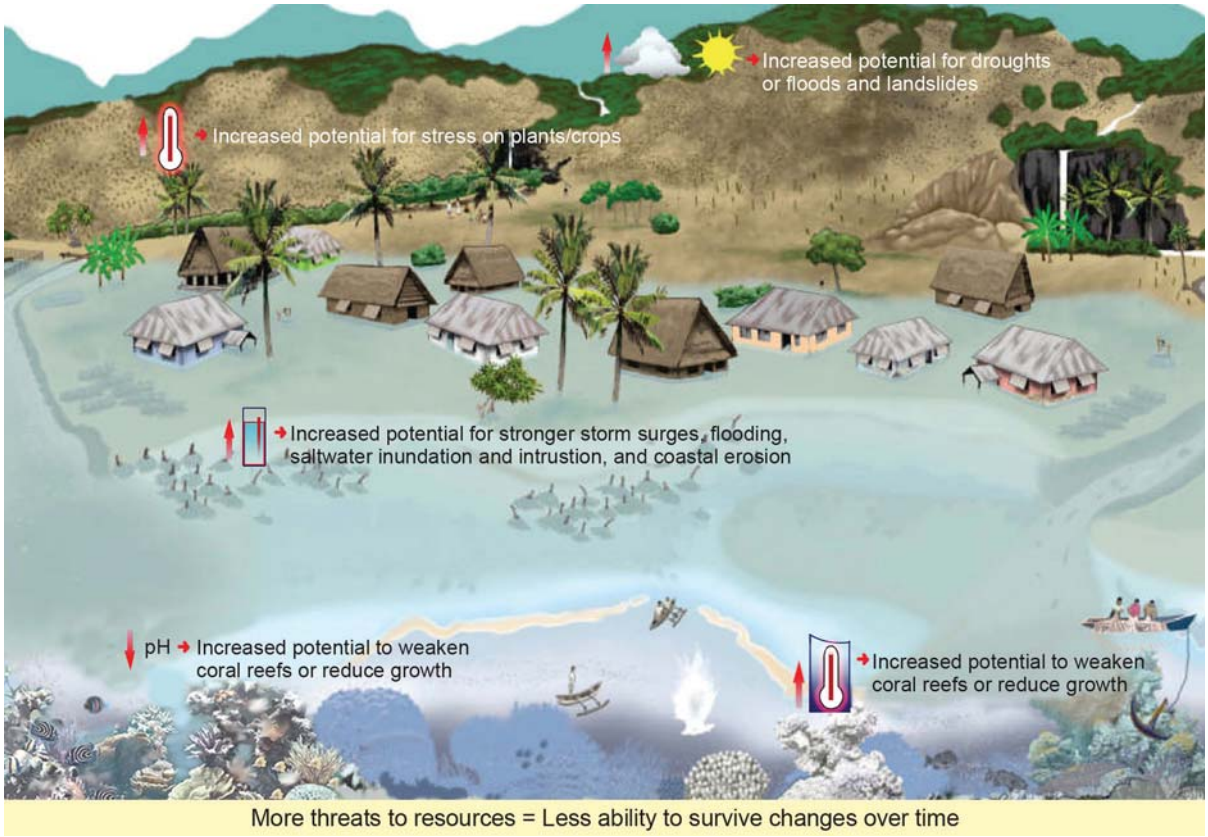


Figure 2.4 Changes to an unhealthy community (adapted from Gombos et al., 2010).

- Preventing the removal of rocks, corals, and sand from the coast helps to buffer against the impact of waves and to protect the shoreline and villages in case of sea-level rise and heavy storms.
- Utilizing and enhancing traditional agro-forestry practices, diversifying new agriculture methods, and using shade trees helps to protect from drought.
- Building partnerships with local agencies and organizations (e.g., resource management, hazard management, health services, community colleges) can increase support for climate change adaptation activities.
- Providing climate information and early warning and building awareness can increase preparedness for known and potential climate change impacts.
- Ensuring that people know about and have access to emergency routes and services and use high areas for evacuation during extreme events (e.g., floods, typhoons) can prevent loss of life.
- Ensuring that people know about and have access to health services can help people cope with climate-related stressors.
- Engaging in alternative livelihood programs can help to diversify income sources.

Additional Technical Resources for Outreach

An *Outreach Toolkit: Adapting to Climate Change* was developed by the Micronesia Conservation Trust and The Nature Conservancy on behalf of the Micronesia Challenge for use in the Micronesia region of the Pacific. It is a wonderful resource for community outreach on climate change and adaptation planning. The tools are listed below:

Gombos, M., Atkinson, S., & Wongbusarakum, S. (2010). Adapting to a changing climate (facilitator's notes). Retrieved from CAKE: http://www.cakex.org/virtual-library/3441.

Gombos, M., Atkinson, S., & Wongbusarakum, S. (2010). Adapting to a changing climate (flipchart). Retrieved from CAKE: http://www.cakex.org/virtual-library/3440.

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

Other good resources on the basics of climate change in plain language include these:

U.S. Environmental Protection Agency (EPA). (2009). Frequently asked questions about global warming and climate change: Back to basics. Retrieved from http://www.epa.gov/climatechange/Downloads/wycd/Climate_Basics.pdf.

United Nations Intergovernmental Panel on Climate Change (IPCC). (2007). Climate change 2007: The physical science basis (working group 1). Retrieved from http://www.ipcc.ch/publications_and_data/ar4/wg1/en/faqs.html.

Adaptation Strategies to Build Resilience of Agriculture and Community Well-Being

The best way to prepare for climate change and avoid negative impacts to important resources is to keep these resources as healthy and strong as possible

Agriculture Adaptation Strategies

1. Diversify agriculture and move crops inland or up, away from inundation areas
2. Use food preservation methods
3. Salt-tolerant species are being explored
4. Utilize and enhance traditional food preservation methods
5. Avoid clearing forests and monocropping
6. Use traditional and native crops
7. Eat locally produced and more nutritious traditional foods “Go Local!”
8. For low-lying islands, raise taro patches through traditional practices of filling with compost or concrete beds

Adaptation Strategies that Support Community Well-being

1. Apply traditional and local knowledge
2. Provide climate information and build awareness for better preparedness
3. Provide access to emergency services and transportation
4. Provide access to health services
5. Develop alternative livelihoods, providing know-how
6. Develop partnerships with other communities and local organizers
7. Organize the community
8. For low-lying areas (and low-lying atolls) put new buildings on stilts to prevent flooding

Figure 2.5 Examples of adaptation actions to build the resilience of agriculture and community well-being (adapted from Gombos et al., 2010).

Activity 2.1 Map the Community

Having a visual representation of target resources and hazards is helpful when the community walks through the Vulnerability Assessment in Step Three. If there is already a resource map for the community, there is no need to create a new one. Just review the existing map with community members and make any necessary updates. If there is no community resource map, create one on large sheets of paper. Then, with the community, use the guidance below to draw features on the map.

Be sure to create a legend so symbols are clearly defined.

1. Identify and mark key habitats and species on the map. Include terrestrial, aquatic, and marine habitats and species such as mangroves, coral reefs, forests, grouper, etc.
2. Write the condition of each key habitat on the map such as good reef areas, damaged reef, healthy streams, polluted streams.
3. Identify and mark areas that are important for key species such as turtle nesting beaches, dugong feeding areas, bird nesting, and spawning aggregations.
4. Identify and mark important social and cultural features such as fishing shrines, houses, fishponds, churches, etc.
5. Draw on the map roads, bridges, buildings, schools, hospitals/clinics, churches, evacuation routes, water reservoirs or tanks, and other community resources.
6. Mark on the map where the key social and economic activities are carried out. Include things such as farming (including type), fishing (including type), harvesting, boating, diving, snorkeling, etc.
7. Include any other features that are important to the community.
8. Identify past hazards that have impacted the community and those zones which were affected such as areas that flood regularly, king tide inundation, saltwater intrusion, tsunami impact zones, etc. You can also revisit the map after you complete the next exercise, the Historical Timeline, to ensure that areas that were impacted by past events were captured. If the community has done a beach profile or a blue line project to estimate 1-meter of sea-level rise (see Appendix A), represent that contour on the map. Understand that this is only an estimate but that it can indicate target resources that might be at risk.

Be sure to take photos of the community map if possible and to store it in a safe place so that you can use the information during the Vulnerability Assessment process in Step Three.

Community Mapping during CCA Training in Papua New Guinea

Activity 2.2 Describe Past Climate Conditions

Exploring the community's history over the past 50 years or more through the creation of a Historical Timeline helps the community record the general climate and weather-related events (e.g., droughts, floods, coral bleaching, crop failures) and natural hazards (e.g., earthquakes, tsunamis) that have happened over the years and identify trends in events (e.g., hazards that are becoming more frequent). Developing an understanding of what impacts these events have had on target resources and of how the community dealt with these changes will help the community during the Vulnerability Assessment process.

To create a Historical Timeline, place large pieces of paper on a wall. Be sure to involve older people who may know more about the historical climate and hazard events than younger people. Draw a timeline dating back about 40 to 60 years (or as far back as the earliest event that is recalled). Draw the line large enough so all the people in the group can see. Place about 30 centimeters of space between each 10-year mark. Ask the group the following questions, and write their responses on the appropriate place in the timeline (see example in Figure 2.6).

Question 1: What is the general/normal climate in this region? Write the answer to this below the timeline.

Question 2: What major weather and climate events or other hazards have happened in your area in the last 40 to 60 years such as droughts, heavy storms, floods, king tides, etc.? On the timeline, list each event the group can remember and the year it happened.

Question 3: What impacts have these events had on the community's target resources such as crop failures, difficulty finding fish, coral bleaching, damage to a hospital or road, etc.? Below the timeline, write each event and its impacts. Also, note if these hazards are increasing or decreasing over time.

Question 4: Were all the community members impacted equally such as the elderly, young, women, fishers vs. farmers, etc.? If not, note which members were more impacted.

Question 5: How did the community cope with the impacts of the event, and were they successful?

Question 6: Based on past experience, which climate events or natural hazards is the community most concerned about happening again? Write these at the bottom of the paper.

Please note: Earthquakes, tsunamis, and volcanic eruptions are not weather or climate events, but they are natural hazards that can be included in the timeline to show how communities cope with natural disasters.

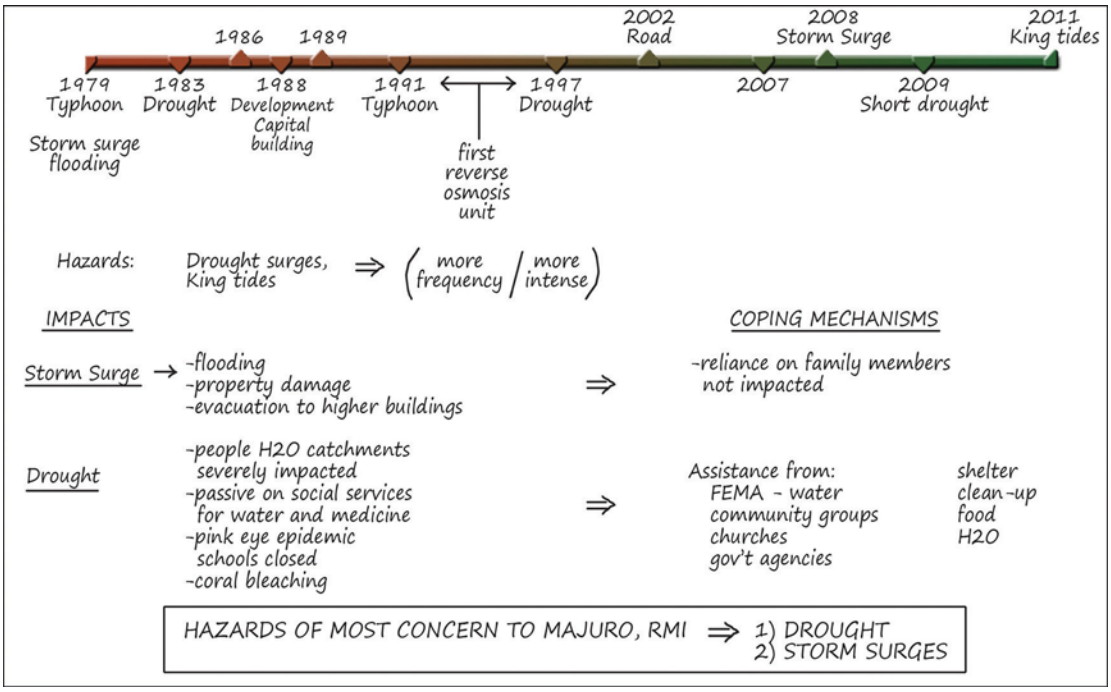


Figure 2.6 Example historical timeline (adapted from Gombos et al., 2010).

Activity 2.3 Describe Current Climate Conditions

In this activity, community members will develop a Seasonal Calendar of what they would have considered a "normal" year with respect to wet versus dry seasons and activities such as planting, harvesting, fish spawning, and so on. Then they will describe any changes to the "normal" timing of these events in order to better understand how climate change currently may be affecting them.

Ensure that many community groups such as farmers, fishers, and womens groups are represented, as they will have different knowledge of the impacts. Community members can work in small groups during this exercise.

A Seasonal Calendar can be created in two ways – circular or linear. For a circular calendar, draw a large circle divided into 12 wedges representing 12 months (see example in Figure 2.7). The second option is to create a linear calendar as shown in Worksheet 2-1.

Worksheet 2-1: Seasonal Calendar

Seasonal Calendar: Normal year in top row; seasonal changes in recent years in bottom row.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Normal Year												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Observed Changes												

Summary of seasonal changes in recent years, along with ecological and social changes:

The small groups should then answer the following questions and capture the information on their calendars:

Question 1: What are the normal seasons throughout the year? On the calendar, draw or list the normal weather conditions that dominate each season (rainy, dry, windy, waves, etc.) and other natural or social events that happen during each season (fruiting, turtle nesting, fish migration, harvesting, etc.).

On the calendar, draw what happens in each month by using a symbol for each type of event. For example, a picture of rain could represent the rainy season. Be sure to create a legend to track the meaning of each symbol. Be sure to include all major climate/weather events and other seasonal events such as fruiting, turtle nesting, fish migration, etc.

Question 2: What changes have you noticed in the seasons? If a group has created a circular calendar, they should list next to the calendar any changes they are observing. If a group is completing a table, have the group draw an identical table below the first one and note the changes they see to each month. This activity can be completed each year to monitor changes in seasons over time.

Question 3: How might these changes impact things such as food, livelihoods, and health? Write these on the paper.

Question 4: What changes are of most concern, and why? For example, perhaps the dry season lasts longer or mango season is shorter, and mango is a key crop for the community. Also note for how long these changes have been noticed. Write these answers below the circular or table calendar.

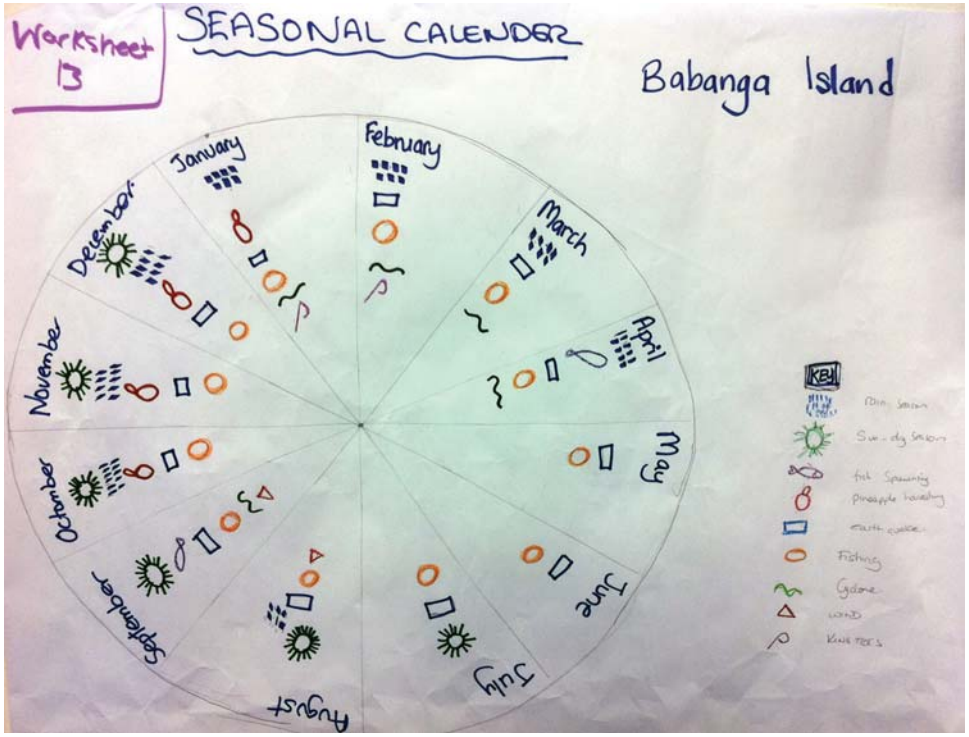


Figure 2.7 Example seasonal calendar (adapted from Gombos et al., 2010).

Additional activities to raise awareness and gather information for the Climate Story

Community walks:

A walk through the community is a simple way to review land use zones and practices, key ecological features, important infrastructure, cultural sites, and threats in various areas of the community. The primary purposes of this exercise are to ground-truth the community map and ensure that key features are noted. Physically walking through the community can help community members recall important sites including evacuation areas, different land-use areas, resources used during emergencies, areas prone to specific hazards, changes to the environment over time, and land tenure. Consider different transects including "ridge-to-reef" to examine how activities in the watershed or uplands impact the coastal area; a shoreline walk to consider the vulnerability of infrastructure and coastal and marine habitats (mangroves, seagrass beds, and coral reefs); or simply walk a transect from the shoreline into the community center. Consider taking pictures to document current conditions, past damage from weather events or natural hazards, and impacts from community activities to include as part of the Climate Story. Once the community walk is completed, revisit the community map and include any features, past hazard impact zones, etc., that were missed during the mapping exercise.

Beach profiling:

Beaches change shape due to storms, extreme tides, and other events that are influenced by climate change. Beaches also change shape when new developments, including piers, jetties, and seawalls, are installed. Monitoring a community's beach over time helps residents understand when and how the beach changes and can help them attribute changes to the climate and non-climate impacts they are experiencing. Beach profiling will also allow the community to estimate the potential impact zone of various levels of sea-level rise. The Emery Method of beach profiling (Appendix A) is a non-technical procedure for communities to use; consider using it as a student project to monitor the community shoreline over time. Once the beach profile is complete, consider marking the estimated 1-meter contour line in the community with blue chalk to illustrate the relative impact of sea-level rise (http://www.bluelineproject.org/). This can also be added to the community map.

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Beach profiling in Papua New Guinea

Activity 2.4 Describe Future Climate Conditions

This section will draw from the local knowledge collected in the previous activities, combined with the latest climate science knowledge, to develop a Climate Story addressing the following questions:

- What climate events have happened in the past?
- How are climate events and seasons changing?
- What resources have been impacted by climate events?
- What events are likely to happen in the future?
- What climate events are of most concern to community members?

Before working with the community to develop the Climate Story, consider what local, national, and regional climate scenarios and projections are available for the community to draw from. Consulting documents such as the latest IPCC assessments, National Adaptation Programmes of Action, information from the government climate change office, meteorological service office, national scientific agencies, agricultural extension agents, and contacting local or regional universities for the latest climate information will strengthen the Climate Story. Even though downscaled regional climate models may not currently be available for the area, the knowledge and observations of the community, combined with indicators of a changing climate, will be enough to accomplish the Vulnerability Assessment in Step Three. Once the scientific climate information and projections for the region have been gathered, consider how best to present the information to the community. It may be helpful to summarize key information in a way

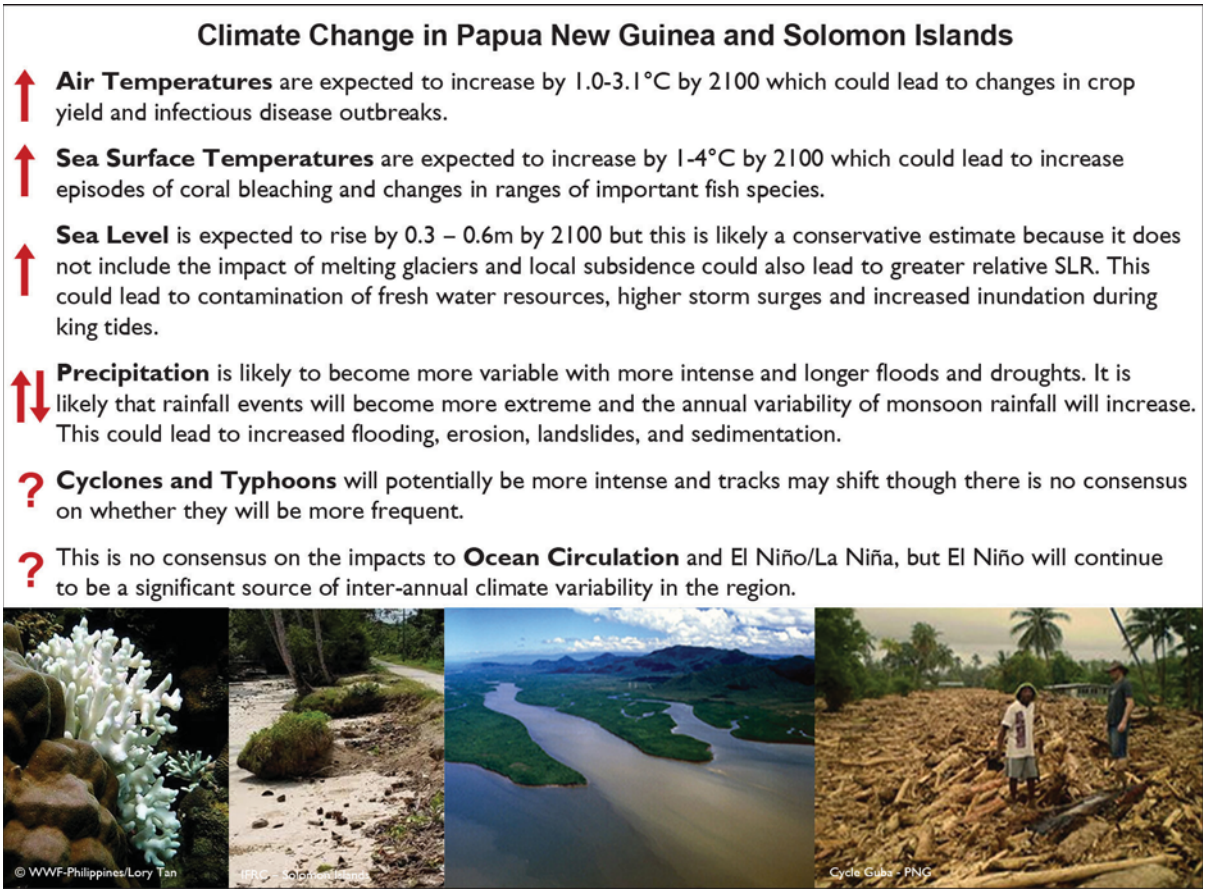


Figure 2.8 Example communication tool for climate change information and impacts based on a training exercise in Papua New Guinea.

that ties it to the impacts the community may experience. Figure 2.8 provides an example of how climate projections might be communicated to a community.

Review the known scenarios and projections with the community. Discuss these changes and add details about the local knowledge and observations from the community to provide additional information. Record this information in Worksheet 2-2, "Indictors of a Changing Climate."

Next discuss the potential impacts to target resources from projected changes in climate. Discuss which threats and impacts might become worse or better with predicted climate impacts. For example, the community has lost crops through drought in the past. Future projections say temperatures will rise and rain will decrease, so there may be more frequent and severe droughts and more crops lost in the future. The water resources may also become scarce in the future because the community is dependent upon rainfall for drinking water. Complete the last column in the table on the worksheet to capture this information and note the issues the community is most concerned about and why.

Worksheet 2-2: Indicators of a Changing Climate

Climate Threat			Impacts
Indicator	Magnitude and direction of change over time based on community knowledge and latest climate science	Changes in environmental conditions	Potential impacts to ecological and social resources
Air temperature			
Sea-surface temperature			
Sea level			
Rainfall patterns			
Ocean pH			
Ocean circulation			
Tropical cyclones			

Additional Technical Resources for Understanding and Visualizing Future Climate Change Impacts

A number of documents and tools are available to assist in the visualization and projection of climate change scenarios and impacts to coastal communities; a small subset is presented here to give an idea of the possibilities if the technical expertise to use them exists in your community or your university or government partners. Some are free for public use, while others require investment in software. Users are encouraged to fully investigate the advantages, limitations, and correct application of each before using outputs as the basis for their adaptation planning. We are not advocating any particular tool.

Burke, L., Reytar, K., Spalding, M., & Perry, A. 2012: Reefs at Risk Revisited in the Coral Triangle. Washington, DC: World Resources Institute. http://www.wri.org/publication/reefs-at-risk-revisited-coral-triangle.

Hoegh-Guldberg et al. (2009). The Coral Triangle and climate change: Ecosystems, people and societies at risk. Brisbane, Australia: World Wildlife Fund.

Keener, V.W., Marra, J.J., Finucane, M.L., Spooner, D., & Smith, M.H. (Eds.). (2012). Climate change and Pacific Islands: Indicators and impacts. Report for the 2012 Pacific Islands Regional Climate Assessment. Washington, D.C.: Island Press.

NOAA State of the Climate: The *State of the Climate* is an annual report that is produced by the National Oceanic and Atmospheric Administration National Climatic Data Center (NOAA/NCDC). The report appears as a supplement to the June issue of the *Bulletin of the American Meteorological Society*. The *State of the Climate* summarizes the global and regional climate of the preceding calendar year and places it into a historical context. In addition, notable climatic anomalies and events are discussed. A website with a collection of monthly summaries recapping climate-related occurrences on both a global and national scale can be found at http://www.ncdc.noaa.gov/sotc/.

Pacific Climate Change Science, Regional Overview (Volume 1) and Country Reports (Volume 2): Includes country-specific projections and climate information including brochures and posters for Timor-Leste, Papua New Guinea, and the Solomon Islands from the Australian Bureau of Meteorology and Commonwealth Scientific and Industrial Research Organisation. Includes "Pacific Climate Futures," a user-friendly web-based tool built upon the extensive analysis of global climate models from climate change in the Pacific. It allows users to explore the likelihood of future changes in temperature, rainfall, wind, sunshine, humidity, and evaporation based on 20-year time periods around 2030, 2055, and 2090 under three greenhouse gas emissions scenarios. Understanding projections of the future climate is essential for underpinning climate change adaptation strategies and contributing to sustainable development (http://www.cawcr.gov.au/projects/PCCSP/publications1.html).

The PRECIS Regional Modeling System: PRECIS was developed by the UK Met Office's Hadley Centre with the goal of quickly and affordably generating high-resolution climate projections for more regions of the world. It is designed with a simple user interface to run on PCs using Linux. Software for generating high-resolution climate projections is freely available. PRECIS can be applied to any area of the globe to generate detailed climate change projections (http://www.metoffice.gov.uk/precis).

SimCLIM is a computer model system for examining the effects of climate variability and change over time and space. Its "open-framework" feature allows users to customize the model for their own geographical area and spatial resolution and to attach impact models. SimCLIM is designed to support decision-making and climate-proofing in a wide range of situations where climate and climate change pose risk and uncertainty. An add-in enables ARCGIS users to bring in climate scenarios for the creation of visualizations (http://www.climsystems.com/simclim/).

Activity 2.5 Identify Ecological and Social Target Resources

An important step in understanding the impacts of climate change is for the community to identify what ecological and social resources it is dependent upon for subsistence and livelihoods. It is likely that in the last activity, you began to identify many of these resources already. During this step, review the Community Background – especially the priority development objectives identified in Step One (Activity 1.2) and the Community Map developed in Activity 2.1. Delve more deeply into discussion with the community about the ecological and social resources that are more important for their lives and livelihood. As part of this discussion, consider the current conditions of these resources and what problems they are facing. As stated previously, climate change can worsen other non-climate threats to resources, so considering the current conditions and threats is important. Complete Worksheet 2-3, "Ecological and Social Target Resources." Begin by reviewing the social and natural targets listed as examples to identify resources of importance to the community. If more than 10 targets are identified, consider whether resources can be lumped into a broader category. As a general rule, resources can be lumped that will have the same basic strategy for protection or management. Be sure to include all resources that are most important to the community for food security, livelihoods, health, and protection from climate impacts. Be sure to include many different groups within the community in the discussion as women, farmers, fishers, etc., may be dependent upon different resources. Indicate whether resource dependency is high, medium, or low. Explain why each resource is important. Capture the current condition of the resource and whether it is getting better, worse, or staying the same. Once you have listed the ecological and social target resources and described their condition, identify links between these resources by considering how the condition of one resource affects the condition of another. It is especially important to think about how a social resource such as dive tourism may be linked to an ecological one such as healthy coral reefs. This information will be helpful when completing the Vulnerability Assessment in Step Three.

Example Target Resources

Ecological Target Resources

- Water: freshwater and seawater quality
- Habitats: coral reefs, mangroves, wetlands, rivers, and streams
- Species: reef fish, invertebrates, food species, threatened or endangered species

Social Target Resources

- Population centers: housing areas, small businesses
- Social services: drinking water, health, education
- Critical infrastructure: roads, power, ports
- Economic activities: agriculture, tourism, fishing

Worksheet 2-3: Ecological and Social Target Resources

ECOLOGICAL AND SOCIAL TARGET RESOURCES				
Priority Target Resources	Resource Dependency	Resource Condition	Resource Linkages	Potential Climate Impacts to Target Resources
List ecological and social targets	*What is the importance of this resource to the community (high, medium, or low), and why?*	*What is the condition of this resource, and is it getting better, worse, or staying the same?*	*How does the condition of this resource affect other ecological and social target resources?*	*What are the potential impacts of climate change to target resources?*
Ecological Targets				
1.				
2.				
3				
4.				
5.				
Social Targets				
6.				
7.				
8.				
9.				
10.				

Activity 2.6 Complete the Climate Story

The final step in developing the community's Climate Story is to pull all of the local observations and knowledge together with the latest climate science available for the area into the story. Start by looking back over the information you gathered throughout this step. Using Worksheet 2-4, summarize the past and present impacts that the community is already observing based on the Historical Timeline, the Seasonal Calendar, and other activities. Using Worksheet 2-2, "Indicators of a Changing Climate," summarize what projected threats and impacts are of most concern to the community and why.

Finally, combine the information from Worksheets 2-2, 2-3, and 2-4 into the Climate Story template. Add information from the Community Background from Step One, and include pictures, stories of the community's experience, or any other information that will help the community document the changes they may see over the next generations to use in the Vulnerability Assessment. Once you have brought all the information together, your Climate Story is complete.

Worksheet 2-4: Summary of Past, Present, and Future Climate Change

Summary of Past, Present, and Future Climate Change
OBSERVATIONS OF PAST AND PRESENT IMPACTS: Based on historical trends, what climate events are most frequent, and which have the greatest impacts? What changes to the normal seasons is the community noticing, and what are the impacts of those changes that most concern the community? Where are these changes or hazards occurring? (Use Historical Timeline and Community Map.)
FUTURE: Based on the community's past experience and the current situation, which of the projected climate threats and impacts most concern the community, and why? (Use available scientific projections, indicators of a changing climate, and observations from past and present.)

Worksheet 2-5: Climate Story Template

COMMUNITY NAME:
[INSERT PICTURE OF COMMUNITY MAP]

INDICATORS OF A CHANGING CLIMATE			
	Climate Threat		Impacts
Indicator	Magnitude and direction of change over time based on community knowledge and latest climate science	Changes in environmental conditions	Potential impacts to ecological and social resources
Air temperature			
Sea-surface temperature			
Sea level			
Rainfall patterns			
Ocean pH			
Ocean circulation			
Tropical cyclones			

OBSERVATIONS OF PAST AND PRESENT IMPACTS: Based on historical trends, what climate events are most frequent, and which have the greatest impacts? What changes to the normal seasons is the community noticing, and what are the impacts of those changes that most concern the community? Where are these changes or hazards occurring? (Use Historical Timeline, Seasonal Calendar, and Community Map.)

[Insert pictures of Historical Timeline and Seasonal Calendar.]

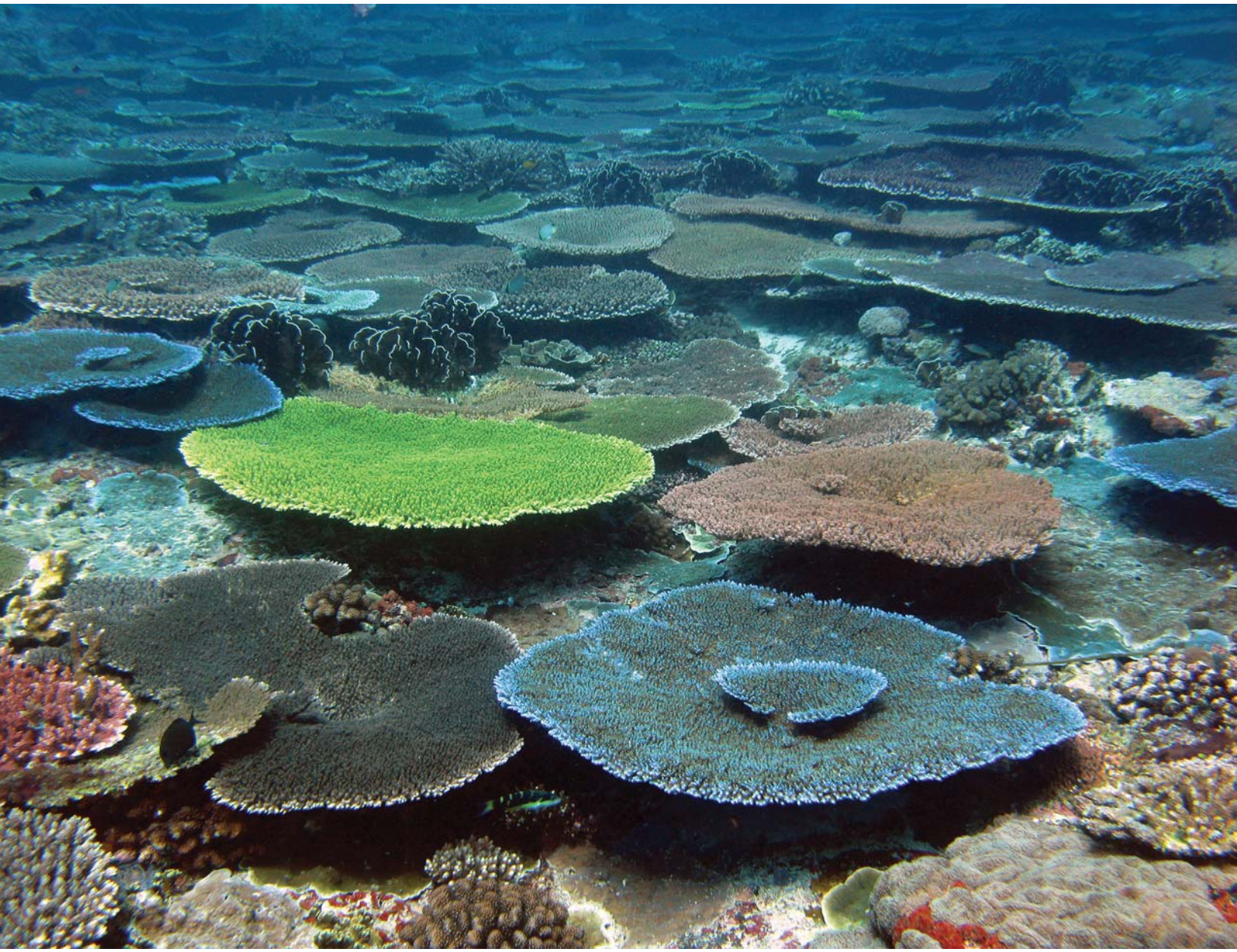
FUTURE: Based on the community's past experience and the current situation, which of the projected climate threats and impacts most concern to the community, and why? (Use available scientific projections, the indicators of a changing climate, and observations from the past and present.)

[Insert other pictures and information the community deems important.]

STEP THREE


1
2
3
4
Getting Organized for CCA Planning
Telling Your Climate Story
Conducting a Vulnerability Assessment
Developing Your Local Early Action Plan

Step Three: Conducting A Vulnerability Assessment



CORAL REEF IN NUSA PENIDA, BALI, INDONESIA © MARTHEN WELLY

Purpose

A vulnerability assessment is an important tool for understanding how climate change will impact social and ecological resources in a community. Vulnerability is determined by assessing the exposure, sensitivity, and adaptive capacity of ecological and social target resources to a climate threat. Ecological and social vulnerability is linked especially in communities highly dependent on natural resources (Figure 3.1).

Vulnerability assessments help to determine which resources are most vulnerable and provide the information needed to identify and prioritize early actions to adapt to climate change. Building on an understanding of past, present, and future climate conditions, coastal communities can assess the vulnerability of both social and ecological resources. The guidance provided in this step will help users conduct a qualitative vulnerability assessment of social, economic, ecological, and infrastructure assets. The output of this step is a Vulnerability Assessment that helps communities understand their vulnerability to climate change impacts and identify actions to most effectively address these impacts.

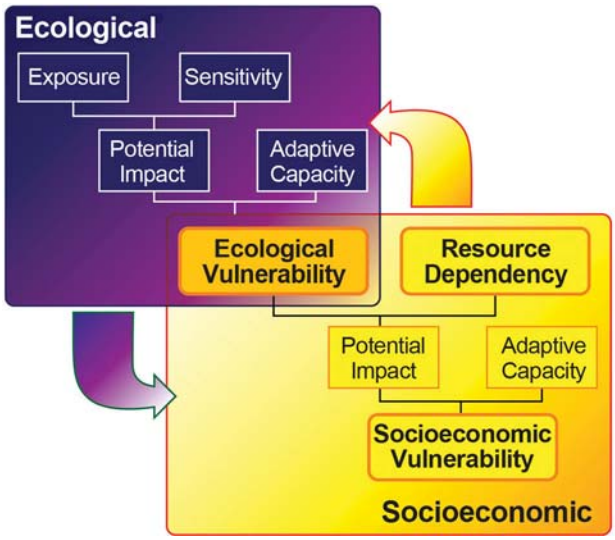


Figure 3.1 Link between social and ecological vulnerability (adapted from Marshall et al., 2010).

Concepts and Terms

Adaptive Capacity: The potential or ability of a target resource to cope with or minimize impacts of climate change. For example, a community shows adaptive capacity by building new homes on stilts or relocating homes to higher ground, thereby reducing the impact of chronic flooding (Figure 3.2).

Climate Threats: The overall change in environmental conditions (e.g., increasing sea surface temperature) resulting from changes in climate due to increasing global greenhouse gas concentrations.

Exposure: The potential for a target resource to come into contact with specific climate threats. For example, a house on the shoreline will be more exposed to storm surges that a house further inland (Figure 3.2).

Non-climate Threats: The vulnerability of target resources can be affected by factors other than climate-related threats. Non-climate threats make existing resources more sensitive to climate impacts. Non-climate threats include natural hazards and local man-made threats. Target resources may be exposed to natural hazards such as tsunamis and earthquakes. Upland deforestation, an example of a man-made threat, can cause sedimentation in nearshore waters, degrading coral reef habitats and making them more sensitive to climate impacts from increased sea-surface temperature and ocean acidification.

Potential Impact: The estimated impact of exposure and sensitivity combined (Figure 3.2).

Resource Dependency: Human actions can adversely impact the natural resources and ecology of an area. Conversely, degraded natural resources and ecosystems can affect adversely affect livelihoods,

food security, and economic development in an area. As a result, the vulnerability of social and ecological systems is co-dependent and linked especially in communities highly dependent on natural resources (see Figure 3.1).

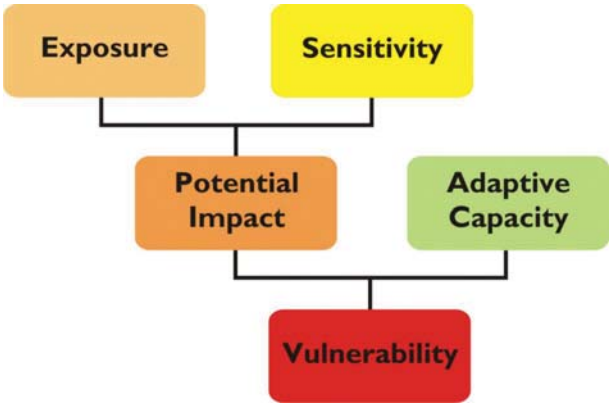


Figure 3.2 Components of vulnerability

Resource dependency describes the link between socioeconomic and ecological systems. Resource dependency may have social dimensions (e.g., attachment to place and family); economic dimensions (e.g., occupation, income, markets); and environmental dimensions (local traditional environmental knowledge, attitudes, and skills) (Marshall et al., 2010). Because of these links, the vulnerability of ecological and social systems must be assessed together.

Sensitivity: The degree to which a target resource is negatively affected by a specific climate impact. For example, a degraded coral reef is more sensitive to increased surface-water temperature than a healthy reef (Figure 3.2).

Target Resource: The social and ecological assets of the community. Social assets may include people, homes, schools, hospitals, roads, businesses, and livelihoods. Ecological assets may include rivers, sand dunes, wetlands, estuaries, mangroves, coral reefs, and fish. Target resources are the focus of vulnerability assessments and adaptation planning.

Vulnerability: The degree to which a human or natural system is susceptible to or unable to cope with adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and the variation to which a system is exposed, its sensitivity, and its adaptive capacity (IPCC, 2001). The system may be an ecological system such as a coral reef or a social system such as a community or economic activities. Ecological and socioeconomic vulnerability are connected due to the importance of ecosystem services on human well-being.

Vulnerability Assessment: An evaluation of the exposure, sensitivity, and adaptive capacity of a target resource to climate threats. It serves to inform adaptation planning.

Overview of Activities

The output of this step is a Vulnerability Assessment. The field-based Vulnerability Assessment provides the community with an engaging way to undertake a simple assessment of vulnerability for their key resources. This assessment will not necessarily be based on external scientific data but on the community's knowledge and experience, together with known climate projections for the future. In some cases, expert opinion may be needed to help understand changes in specific target resources over time, potential future impacts, as well as determining effective actions. We have purposely kept this process straight forward, fast, and simple so the CCA Planning Team can work with the community to move quickly from planning to action. The Vulnerability Assessment draws upon the identification of target resources and climate threats from the Climate Story in Step Two. Step Three is organized into the following activities:

Prepare for a field assessment (Activity 3.1). This activity will help you to prepare a field team to conduct a field assessment with the community. An important part of this activity is to review the information gathered in Step Two, "Developing Climate Story." It is helpful to invite technical experts such as those from local universities and government agencies to assist in conducting the vulnerability assessment and provide insights on potential impacts to target resources.

Describe target resource conditions and trends (Activity 3.2). This activity will help the field team and community to describe the existing conditions and trends related to target resources and identify the non-climate threats and root causes responsible for these trends. The existing conditions and trends of target resources must be factored into the Vulnerability Assessment. By identifying root causes, the community will also be able to identify early actions that will have the best chance of addressing non-climate and climate threats to resources.

Describe exposure to climate threats (Activity 3.3). This activity will help you determine the degree to which target resources are exposed to climate threats. You will draw upon the Climate Story developed in Step Two to identify the range of climate threats that could affect the target resources.

Describe sensitivity to climate threats (Activity 3.4). This activity will help you to describe the sensitivity of target resources to climate threats. Sensitivity is often related to the existing conditions of target resources. You will draw from the results of Activity 3.2 to complete this part of the vulnerability assessment.

Assess potential impacts to target resources (Activity 3.5). In this activity, you will consider both the exposure and sensitivity to define the potential impacts of climate-related threats to target resources. You will draw upon the results of Activities 3.3 and 3.4 to assess the potential impact.

Describe the adaptive capacity of target resources and the community (Activity 3.6). In this activity, you will describe the ability of target resources and the community to cope with the potential impacts of climate change. The adaptive capacity either can offset or reduce the potential impact or can increase vulnerability.

Assess the vulnerability of target resources (Activity 3.7). In this activity, you will consider potential impacts and adaptive capacity in order to assess target resources' vulnerability to climate change. You will draw upon the results of Activities 3.5 and 3.6 to assess the vulnerability of target resources. You will also indicate potential actions that can be taken to reduce vulnerability. The output of this activity is a completed Vulnerability Assessment Matrix for one or more target resources. Example Vulnerability Assessment Matrices are provided in Table 3.1, Table 3.2, and Table 3.3. Activities 3.2 through 3.7 are repeated for each target resource.

Compare the vulnerability of target resources (Activity 3.8). Depending upon the needs and capacity of the community, not all target resources may be priorities for adaptation planning. In addition, the vulnerability of some target resources may require additional technical input and partners to move adaptation forward. This activity will help you compare the vulnerability of target resources and identify opportunities to integrate the results into planning. An example Vulnerability Assessment Summary is provided in Table 3.4. The Vulnerability Assessment will be used to develop a LEAP in Step Four.

Table 3.1 Example Vulnerability Assessment Matrix for a Social Target Resource

TARGET RESOURCE: *Drinking water wells are the sole source of water for the community and local dive tourism resorts.* CONDITION AND TRENDS: *Drinking water quality and quantity is poor and declining because of saltwater intrusion from overdrawing groundwater sources associated with the growth of the dive tourism industry.*					Condition and Trend Rating *POOR* ↓
CLIMATE THREATS	EXPOSURE	SENSITIVITY	POTENTIAL IMPACT (Exposure + Sensitivity)	ADAPTIVE CAPACITY	VULNERABILITY (Potential Impact + Adaptive Capacity)
More drought conditions reducing groundwater recharge and increasing saltwater intrusion *Sea-level rise causing saltwater intrusion*	*Highly exposed to climate threats, particularly saltwater intrusion to wells close to the coastline*	*Highly sensitive to saltwater intrusion because of existing poor and declining condition of drinking water from coastal wells* *Drought – moderately because it can recharge if there is enough new water*	*High – all water resources are exposed and sensitive to these events.*	*Low – water resources have little to no adaptive capacity with climate threats on their own, and technological solutions such as desalination are cost-prohibitive*	*Drinking water resources are highly vulnerable to climate change. As a result, the community will be highly vulnerable due to its dependence on water resources for drinking, agriculture, and potential health risks from waterborne diseases.*
	Exposure Rating	Sensitivity Rating	Potential Impact Rating	Adaptive Capacity Rating	Vulnerability Rating
	HIGH	HIGH	HIGH	LOW	HIGH
	VULNERABILITY STATEMENT: • **Condition and Trends:** *Drinking water quality and quantity is poor and declining because of saltwater intrusion from overdrawing groundwater sources associated with the growth of the dive tourism industry.* • **Vulnerability:** *Climate-related droughts, storm surge, and sea-level rise are expected to reduce the quantity and quality of drinking water resources.* • **Resource Dependency:** *No other sources of drinking water are available to the community.*				

Table 3.2 Example Vulnerability Assessment Matrix for an Economic Target Resource

TARGET RESOURCE: *Local Dive Tourism Industry* **CONDITION AND TRENDS:** *The local dive tourism industry has continued to grow over the last 5 years. It now provides jobs for members of the community and contributes to the growth of small businesses in the area.*					Condition and Trend Rating *GOOD ↑*
CLIMATE THREATS	EXPOSURE	SENSITIVITY	POTENTIAL IMPACT (Exposure + Sensitivity)	ADAPTIVE CAPACITY	VULNERABILITY (Potential Impact + Adaptive Capacity)
Severe storms causing damaging wind conditions *Coastal inundation from severe storms* *Coastal erosion from severe storms and coastal inundation* *Sea-level rise causing coastal inundation*	*Resorts on the coast are directly exposed to severe storms, coastal inundation and erosion, and sea-level rise.* *Basic services such as wastewater and drinking water and transportation infrastructure such as airport, roads, and harbors that bring diving visitors to the area will be exposed to climate threats.*	*Some resorts are built to withstand high winds, but most resort infrastructure is sensitive to flooding and storms.* *Coral reefs fronting the resort area have been degraded by anchor damage, reducing the capacity to buffer the shoreline from large waves and increasing coastal erosion.*	*High potential impact due to high exposure and high sensitivity*	*Dive tourism industry is installing mooring buoys to minimize anchor damage and support restoration of coral reefs.* *Local government is conducting a vulnerability assessment of critical infrastructure to identify potential adaptation options to reduce risk to basic services and transportation that supports the resorts.*	
	Exposure Rating	Sensitivity Rating	Potential Impact Rating	Adaptive Capacity Rating	Vulnerability Rating
	HIGH	HIGH	HIGH	HIGH	MEDIUM
	VULNERABILITY STATEMENT: • **Condition and Trends:** *The local dive tourism industry has continued to grow over the last 5 years, now provides jobs for many members of the community, and has contributed to the growth of small businesses in the area.* • **Vulnerability:** *Climate-related severe storms and storm surge and sea-level rise are expected to result in damaged infrastructure that supports tourism including resorts, basic services, and transportation infrastructure such as airport and harbor. Anchoring damage has degraded coral reefs fronting tourism resorts, thereby decreasing capacity to buffer the shoreline from strong waves.* • **Resource Dependency:** *The local dive tourism industry is highly dependent on maintaining healthy and diverse coral reefs and fisheries for divers to explore.*				

Table 3.3 Example Vulnerability Assessment Matrix for an Ecological Target Resource

TARGET RESOURCE: *Coral reefs* CONDITION AND TRENDS: *Coral reefs in the area are in good condition but declining because of sedimentation from increasing deforestation in the watershed and anchor damage from dive tourism industry. Destructive fishing practices have been an issue in the past, but the community has successfully been addressing this issue.*					Condition and Trend Rating *GOOD/FAIR ↓*
CLIMATE THREATS	EXPOSURE	SENSITIVITY	POTENTIAL IMPACT (Exposure + Sensitivity)	ADAPTIVE CAPACITY	VULNERABILITY (Potential Impact + Adaptive Capacity)
More severe rainfall events creating more surface water runoff *Increased sea-surface temperature* *Ocean acidification*	*Highly exposed to climate threats, particularly increased runoff, sea-surface temperature, and ocean acidification*	*Coral reefs have medium sensitivity to increased sea-surface temperature due to climate change. Few corals were bleached in the last event compared to the level of bleaching in nearby coral reefs. Strong nearshore currents help move sediments off coral reef habitats.*	*Medium potential impact - Coral reefs are highly exposed to climate threats but moderately sensitive to these threats.*	*Medium adaptive capacity – coral reefs exposed to previous bleaching events have recovered.* *Community is improving enforcement of regulations that prohibit destructive fishing practices. Improved watershed management is needed to reduce deforestation.*	*Coral reef vulnerability to climate change is rated as medium.*
	Exposure Rating	Sensitivity Rating	Potential Impact Rating	Adaptive Capacity Rating	Vulnerability Rating
	HIGH	MEDIUM	MEDIUM	MEDIUM	MEDIUM
	VULNERABILITY STATEMENT: • **Condition and Trends:** *Coral reefs in the nearshore waters of the community are healthy but becoming degraded by sedimentation from upland deforestation and destructive fishing.* • ***Vulnerability:*** *Coral reefs are vulnerable to increased sea-surface temperature, ocean acidification, and increased sediment runoff from severe storms.* • **Resource Dependency:** *Coral reefs provide food security for the community and support a dive tourism industry that provides jobs and supports small businesses in the area.*				

Table 3.4 Example Vulnerability Assessment Summary

TARGET RESOURCE	VULNERABILITY STATEMENT	CONDITION AND TRENDS RATING	VULNERABILITY RATING
Drinking Water	• **Condition and Trends:** *Drinking water quality and quantity is poor and declining because of saltwater intrusion from overdrawing groundwater sources associated with the growth of the dive tourism industry.* • **Vulnerability:** *Climate-related droughts, storm surge, and sea-level rise are expected to reduce the quantity and quality of drinking water resources.* • **Resource Dependency:** *No other sources of drinking water are available to the community.*	*POOR* ↓	*HIGH*
Local Dive Tourism Industry	• **Condition and Trends:** *The local dive tourism industry has continued to grow over the last 5 years and now provides jobs for many members of the community and has contributed to the growth of small businesses in the area.* • **Vulnerability:** *Climate-related severe storms and storm surge and sea-level rise are expected to result in damaged infrastructure that supports tourism.* • **Resource Dependency:** *The local dive tourism industry is highly dependent on maintaining healthy and diverse coral reefs and fisheries for divers to explore.*	*GOOD* ↑	*MEDIUM*
Coral Reefs	• **Condition and Trends:** *Coral reefs in the nearshore waters of the community are healthy but becoming degraded by sedimentation from upland deforestation and destructive fishing.* • **Vulnerability:** *Coral reefs are vulnerable to increased sea-surface temperature, ocean acidification, and increased sediment runoff from severe storms.* • **Resource Dependency:** *Coral reefs provide food security for the community and support a dive tourism industry that provides jobs and supports small businesses in the area.*	*GOOD/FAIR* ↓	*MEDIUM*

Community Experience: Papua New Guinea

Communities living on low-lying islands in Manus Province, Papua New Guinea, are highly vulnerable to climate impacts. After experiencing their first king tide, communities and the government were motivated to assess their vulnerability and develop LEAPs to address climate impacts at the provincial and community level. The island population, water wells, buildings, and food gardens were among some of the social assets exposed to climate threats. Houses built on the ground were more sensitive to coastal inundation than those built on stilts. The communities' adaptive capacity was increased by developing an improved early warning system and community-based disaster management program that warned residents of extreme events using the radio and helped residents evacuate to the mainland island. (Case study provided courtesy of CCA Training Participants from Manus Province.)

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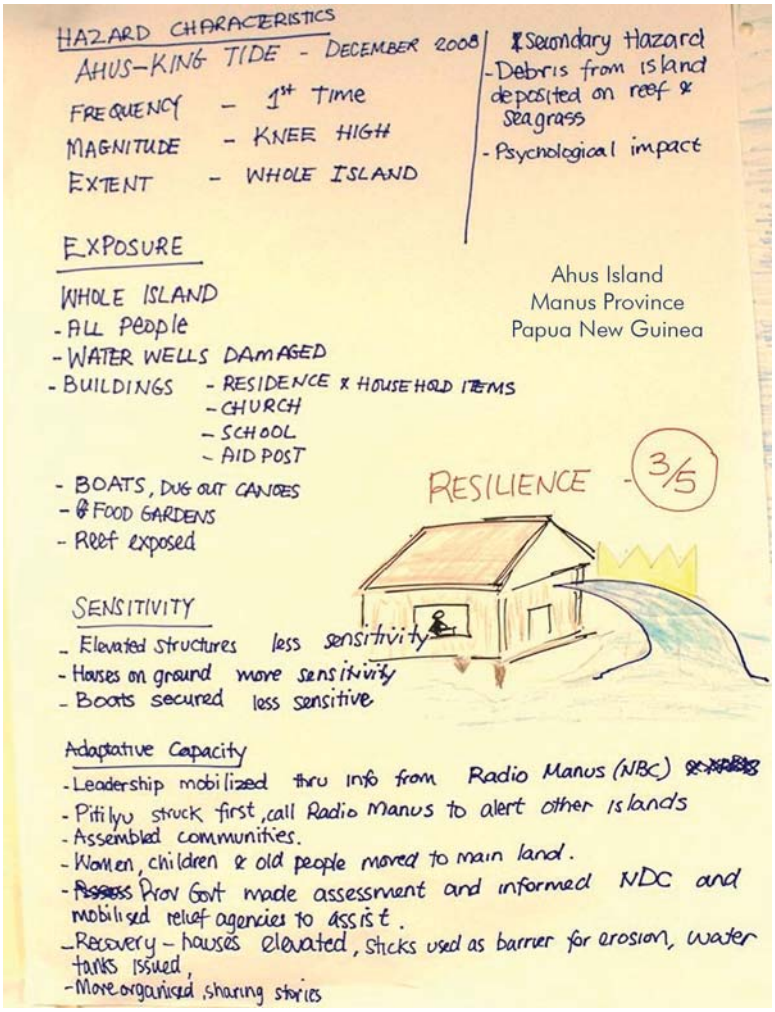
Training participants from Manus Province working on a vulnerability assessment based on the community of Ahus.



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Identification of target resources and initial assessment of vulnerability components for Ahus, Manus Province, Papua New Guinea

Activity 3.1 Prepare for a Field Assessment

Making observations and collecting information in the field is an important part of conducting a vulnerability assessment. To get started, the CCA Planning Team will need to meet with the field team (described below) to make sure everyone has a clear understanding of the tasks to be accomplished.

Organize the team. The field team will be responsible for making observations and collecting information on the vulnerability of target resources to climate and non-climate threats. It is helpful to have a diverse team composed of community members and individuals that are familiar with the area and community where the assessment will be conducted in addition to those that may have some specialized technical expertise. For example, someone who knows about how the area's mangroves have changed over time should be in the mangrove group. The field team should be an expansion of the CCA Planning Team so that there are plenty of people to work through the vulnerability assessment with the community.

The field team leader should divide the field team into groups based on the target ecological and social resources. If you don't have enough people, each group can work on two or more similar resources. Each group should have someone that knows the history and condition of the resource. Each group should have a group facilitator responsible for leading the group through the assessment questions and taking notes. The group facilitator should review and understand the questions and the relationship between exposure, sensitivity, potential impact, adaptive capacity, and vulnerability (see "Concepts and Terms," above. Each facilitator should have a clipboard with a copy of all the worksheets (Worksheets 3-1 to 3-7). Each should also have a copy of the summary of the Climate Story developed in Step Two.

Review concepts, terms, and worksheets. The field team leader should lead the team through a review of the vulnerability model and key terms. Let the team know that they will be using these terms to explore the vulnerability of each of the community's key natural and social resources. The field team leader should go through each term and have the team write or explain these terms in local language and provide examples to make sure that the terms are understood. Tell the team that there are questions that will be used to help each small group determine rankings for each of these terms.

Review the Climate Story from Step Two. The Climate Story from Step Two captures priority target resources and associated climate threats. If possible, provide copies of the Climate Story for each small group. If this is not possible, review the Climate Story with the team, and have each group write notes from the story to take with them to the field. Be sure to capture the potential future climate threats about which the community is most concerned.

Prepare maps and other materials. Each group should prepare a simple sketch map of the community based on the Community Map from Step Two. Each group should take this small map with them to use during the field assessment. If possible and where appropriate, use a camera to document observations of a target resource, including the condition, climate and non-climate threats, and exposure to climate threats.

Conduct field activities. Each group should go into the community and view the resource it is working on. While viewing the resource, the group facilitator should first review the Climate Story including the main climate events about which the community is most concerned. Next, the group facilitator should ask field assessment participants the questions listed in the vulnerability assessment

worksheets. The group facilitator should use the questions to help determine the answers for the associated columns in each worksheet. The group should also update their sketch map with the location and condition of the target resource as needed.

Present results. Once the groups have completed their assessment, there should be an opportunity for all the groups to come together and present the results of vulnerability assessments with the community. Be sure to use a flip chart to capture major threats, root causes of threats, vulnerabilities, and actions developed by each group. The rest of the community should ask questions or revise information as needed.

Each group should also present any changes or updates that they can now recommend to improve the community map based on field observation of the resource. After all groups have presented, the community with the field team should discuss which resources seem to be the most vulnerable and why, and which actions they recommend taking to reduce threats, reduce vulnerability, and improve adaptive capacity.

After reviewing all of the resources, the community and the field team should work together to decide which actions should be considered in Step Four of the LEAP process. All actions chosen should be those that will best help reduce the vulnerability of the resource and the community. Include as many actions that the community deems important to reduce vulnerability by reducing threats. While some actions may require additional resources or technical expertise, it is important to include these if they will significantly reduce vulnerabilities.

If there is time to review actions developed for resources that are less vulnerable, these should also be included. All actions that seem feasible for the community to carry out can be included in the LEAP document. However, be sure to balance the number of actions between what is realistic to do and what is most important to do. Also be sure that the actions address the root causes for the most vulnerable resources and community members.

Activity 3.2 Describe Target Resource Conditions and Trends

In this activity you will describe the current conditions and trends of target resources that are important to the community and the non-climate threats influencing their condition (Worksheet 3-1). The current condition describes the state or health of a target resource. The trend describes whether the condition is declining, improving, or staying the same. You will also identify any non-climate threats affecting the target resource and their root causes. The field team will review, refine, and summarize the information from Worksheet 2-3, "Ecological and Social Target Resources," for a specific target resource identified in Step Two, "Telling Your Climate Story."

EXAMPLE TARGET RESOURCE CONDITIONS AND TRENDS SUMMARY

Target Resource: *Reef Fish*

Condition and Trend: ***POOR*** ↓

Non-Climate Threat: *Destructive fishing and overfishing*

Destructive fishing and overfishing are resulting from inadequate fisheries management – in particular weak enforcement of existing regulations. Increased enforcement with support from the community is helping to improve the condition of reef fish.

Describe the target resource current condition and trend based on local knowledge, scientific assessments, or other sources of information. Identify the non-climate stressors responsible for the condition and trend in the target

resource. To identify root causes to your resources, ask the group, "Why are those threats occurring?" The facilitator should keep asking, "Why is that happening?" until the "root causes" of the threat are revealed and there are no more answers. When there are no more reasons for why the threat is happening, the facilitator should review the answers and ask, "If all of these causes were addressed, would the threat be reduced?" If the answer is "yes," then the group can move on to the next non-climate threat. Facilitators should use the following questions in the field to help support the appropriate answers to the core questions in the matrix. Read the definition, example, and any other information to the group before asking each set of questions. Transfer the condition and trend rating and summary to Worksheet 3-7, "Vulnerability Assessment Matrix."

Condition and Trend Rating					
Good	Good/Fair	Fair	Fair/Poor	Poor	Undet.

Trends:

↑ Condition appears to be improving.

— Condition does not appear to be changing.

↓ Condition appears to be declining.

? Undetermined trend

Worksheet 3-1: Target Resource Conditions and Trends

TARGET RESOURCE CONDITIONS AND TRENDS	
TARGET RESOURCE: Consider social (people, health, social networks); economic (property, infrastructure, income); and ecological (natural resources and ecological services) targets. Current Conditions: Describe the current conditions of the target resource. Trend: Describe the trend of the target resource.	Condition and Trend Rating
List Non-Climate Threats and Root Causes	
SUMMARY	

Activity 3.3 Describe Exposure to Climate Threats

In this activity, you will describe the exposure of the target resource to climate threats (Worksheet 3-2). Review the climate threats identified in Step Two, "Telling your Climate Story," and then answer the questions in the worksheet below. Rate the exposure of the target resource to climate threats as high, medium, and low. Transfer this rating and a summary of the exposure of the target resource to climate threats to Worksheet 3-7, "Vulnerability Assessment Matrix."

EXAMPLE EXPOSURE SUMMARY

Target Resource: *Drinking water wells*

Exposure: *HIGH*

Summary Description: *Drinking water wells in low lying coastal areas are highly exposed to sea-level rise and coastal inundation from severe storms. These threats are increasing.*

Worksheet 3-2: Exposure of Target Resource to Climate Threats

EXPOSURE	
TARGET RESOURCE: Which climate threats have come into contact with this resource or will in the future, based on climate projections? Are these threats increasing or decreasing? In the future, will this resource come into contact with these threats rarely, sometimes, or frequently? Specify which threats.	
Rate the degree of exposure of the target resource to climate threats as **low, medium, or high.**	RATING
SUMMARY	

Activity 3.4 Describe Sensitivity to Climate Threats

In this activity, you will describe the sensitivity of the target resource to climate threats (Worksheet 3-3). Review target resource conditions and trends from non-climate threats described in Worksheet 3-1, and then answer the questions in the worksheet below. Rate the sensitivity of the target resource to climate threats as high, medium, or low. Transfer this rating and a summary of the sensitivity of the target resource to climate threats to Worksheet 3-7, "Vulnerability Assessment Matrix."

EXAMPLE SENSITIVITY SUMMARY

Target Resource: *Coral Reefs*

Sensitivity: *HIGH*

Summary Description: *Coral reefs are highly sensitive to increasing sea-surface temperature, which causes coral bleaching because reefs have already been degraded by sedimentation from runoff from upland deforestation and have previously experienced bleaching.*

Worksheet 3-3: Sensitivity of Target Resource to Climate Threats

SENSITIVITY	
TARGET RESOURCE: What is the current condition of the target resource? What man-made (non-climate) threats are impacting the target resource? How severe are those threats? How severely was this target resource impacted by past climate events? How will future climate threats affect the condition of the target resource?	
Rate the sensitivity of the target resource to climate threats as **low, medium, or high.**	RATING
SUMMARY	

Activity 3.5 Assess Potential Impacts to Target Resources

In this activity, you will assess the potential impact of climate change to target resources (Worksheet 3-4). Use the exposure-sensitivity matrix below. Rate the potential impact of the target resource to climate threats as high, medium, and low. Transfer this rating and a summary of the potential impact to the target resource that describes the exposure and sensitivity of the target resource to climate threats to Worksheet 3-7, "Vulnerability Assessment Matrix."

SENSITIVITY			
RATING	Low	Medium	High
High	*Medium*	*Medium*	*High*
Medium	*Low*	*Medium*	*Medium*
Low	*Low*	*Low*	*Medium*

EXAMPLE POTENTIAL IMPACT SUMMARY

Target Resource: *Houses along the coast*

Potential Impact: *MEDIUM*

Summary Description: *The potential impact of climate change to houses along the coast is rated as Medium. These houses are highly exposed to sea-level rise and coastal inundation from severe storms; however, the elevated housing design reduces the sensitivity of these structures to climate change related threats.*

Worksheet 3-4: Potential Impact Rating

POTENTIAL IMPACT (Exposure + Sensitivity)	
TARGET RESOURCE:	
Rate the potential impact to the target resource based on the exposure and sensitivity as **low, medium, or high.**	RATING
SUMMARY	

Activity 3.6 Describe the Adaptive Capacity of Target Resources and the Community

In this activity, you will describe the ability of the target resource and the community to adapt to climate threats (Worksheet 3-5). The adaptive capacity may be described as a response of the target resource itself and a response of the community to minimize the potential impact of the climate threat on the target resource. As such, describing the adaptive capacity is an important component in understanding the overall vulnerability as well as forecasting potential areas for planned adaptation. Rate the adaptive capacity to climate threats as high, medium, and low. The rating system for this aspect of the vulnerability assessment is opposite of exposure and sensitivity.

Remember that rating the adaptive capacity as "high" is a positive outcome. This means that the potential impact can be minimized.

EXAMPLE ADAPTIVE CAPACITY SUMMARY

Target Resource: *Mangroves*

Adaptive Capacity: *HIGH*

Summary Description: *Mangroves are expected to be highly adapted to sea-level rise. The absence of human settlements in the vicinity will allow mangroves to migrate landward as sea level rises. In addition, the local government has adopted an effective land-use policy to protect mangroves from future encroachment.*

Rating the adaptive capacity as "low" means the potential impact of climate change cannot be offset. The adaptive capacity rating is the inverse of the ratings for sensitivity and exposure, where a "high" rating was bad for the resources and a "low" rating was good for the resources. Transfer the rating and a summary of the adaptive capacity to climate threats to Worksheet 3-7, "Vulnerability Assessment Matrix."

FACTORS TO CONSIDER IN RATING ADAPTIVE CAPACITY

What is the adaptive capacity of the natural environment to withstand climate threats?

- Extent to which key natural resources have resisted change or recovered from climate or non-climate threats
- Effectiveness of current formal or informal natural resource management regimes

What is the adaptive capacity of the community to withstand climate threats?

- Local knowledge; access to information, practices, and mechanisms to cope with climate events and impacts
- Effectiveness and access to early warning systems
- Effectiveness and access to social networks
- Capacity to plan, learn, and reorganize
- Dependence of community on natural resources for food security and livelihoods
- Current livelihood diversification and the extent to which livelihoods are climate-dependent
- Access to financial and material resources

What is the adaptive capacity of institutions to support climate adaptation?

- Presence/effectiveness of conditions that support adaptation leaders (e.g., processes to pass learning from one person/project to another, mentoring)
- Effectiveness of and access to institutions supporting adaptation
- Presence/effectiveness of learning processes that support adaptation (e.g., extent to which community has processes/culture to stimulate learning through experimentation, to assess outcomes, and to use results to improve adaptation strategies)

Worksheet 3-5: Adaptive Capacity to Climate Impacts

ADAPTIVE CAPACITY	
TARGET RESOURCE: What is the adaptive capacity of the natural environment to withstand climate impacts? Have you observed recovery or resilience to past hazards in this resource? Explain. What actions have been/are being taken to prepare for or cope with potential impacts to this resource? Are there existing systems in place that could reduce potential impacts of climate change? What is the adaptive capacity of the community to withstand climate impacts? How has the community been able to withstand other types of hazards or challenges? What is the adaptive capacity of institutions to support climate adaptation? Are national or local governments and organizations supporting planned adaptation?	
Rate the adaptive capacity of the target resource and the community to climate impacts as **low, medium, or high.**	RATING
SUMMARY	

Activity 3.7 Assess the Vulnerability of Target Resources

The vulnerability of target resources is dependent upon the potential impact (exposure and sensitivity) and adaptive capacity. Use the "Potential Impact" and "Adaptive Capacity" ratings from the previous worksheets to assess the vulnerability of target resources to climate change–related threats using Worksheet 3-6, "Vulnerability Rating." Transfer the rating and a summary of the adaptive capacity to climate threats to Worksheet 3-7, "Vulnerability Assessment Matrix." This is the final activity for assessing vulnerability for each target resource. Examples of completed Vulnerability Assessment Matrices are provided in Table 3.1, Table 3.2, and Table 3.3.

EXAMPLE VULNERABILITY SUMMARY

Target Resource: *Boat Dock*

Vulnerability: *HIGH*

Summary Description: *The boat dock is highly vulnerable to sea-level rise, coastal inundation, and severe storms. The potential impact of these climate threats to the boat dock is high because of its highly exposed location and because the lack of maintenance of the infrastructure makes it highly sensitive. The adaptive capacity is low because of the absence of funds for maintenance and the high dependence of the community on the dock for importation of food and water from the mainland.*

As a last step in completing the "Vulnerability Assessment Matrix" (Worksheet 3-7), develop a simple Vulnerability Statement. In a few sentences, the Vulnerability Statement should capture

- the current condition and trends of the target resource and the non-climate threats impacting the target resource;
- the overall vulnerability of the target resource due to climate threats; and
- the dependency of the community on the target resource.

The Vulnerability Statement helps to draw all the individual pieces of the "Vulnerability Assessment Matrix" into a simple statement that can be used to guide planning. Transfer the statement to Worksheet 3-7, "Vulnerability Assessment Matrix." This is the final activity for assessing vulnerability for each target resource.

Vulnerability Rating Matrix

POTENTIAL IMPACT	ADAPTIVE CAPACITY		
RATING	Low	Medium	High
High	*High*	*Medium*	*Medium*
Medium	*Medium*	*Medium*	*Low*
Low	*Low*	*Low*	*Low*

EXAMPLE VULNERABILITY STATEMENT

- **Conditions and Trends:** *The current condition of the boat dock is poor and deteriorating due to a lack of maintenance.*
- **Climate Vulnerability:** *The boat dock is highly vulnerability to climate-related threats such as severe storms and sea-level rise, which is expected to disrupt public services.*
- **Resource Dependency:** *The boat dock is the only offloading point for fuel, water, and food for the island community. Solid waste and fuel spills from the dock are degrading water quality and adjacent seagrass habitats, making them more sensitive to climate impacts.*

Worksheet 3-6: Vulnerability Rating

VULNERABILITY (Potential Impact + Adaptive Capacity)	
TARGET RESOURCE:	
Rate the vulnerability of target resource based on the potential impact and the adaptive capacity as **low, medium, or high.**	RATING
SUMMARY	
VULNERABILITY STATEMENT	

Worksheet 3-7: Vulnerability Assessment Matrix

TARGET RESOURCE: CONDITION AND TRENDS:					Condition and Trend Rating
CLIMATE THREATS	EXPOSURE	SENSITIVITY	POTENTIAL IMPACT (Exposure + Sensitivity)	ADAPTIVE CAPACITY	VULNERABILITY (Potential Impact + Adaptive Capacity)
	Exposure Rating	Sensitivity Rating	Potential Impact Rating	Adaptive Capacity Rating	Vulnerability Rating
	VULNERABILITY STATEMENT: Condition and Trends: Vulnerability: Resource Dependency:				

Activity 3.8 Compare the Vulnerability of Target Resources

If a Vulnerability Assessment Matrix has been completed for multiple target resources in the community, then a comparison of target resources provides a starting point for planning. This activity is intended to consolidate the key outputs of the Vulnerability Assessment Matrix for each target resource, which can be used in the next step for planning (Worksheet 3-8). This activity should be completed by the CCA Planning Team, the field team, and community members. An example of a completed Vulnerability Assessment Summary is provided in Table 3.4.

Worksheet 3-8: Vulnerability Assessment Summary

TARGET RESOURCE	VULNERABILITY STATEMENT	CONDITION AND TRENDS RATING	VULNERABILITY RATING

STEP FOUR


1
2
3
4
Getting Organized for CCA Planning
Telling Your Climate Story
Conducting a Vulnerability Assessment
Developing Your Local Early Action Plan

STEP FOUR: DEVELOPING YOUR LOCAL EARLY ACTION PLAN

MANGROVES IN NUSA PENIDA, BALI, INDONESIA © MARTHEN WELLY

Purpose

Communities that plan for adaptation have decided to proactively take steps to reduce their vulnerability to climate change. Planned adaption uses the results of vulnerability assessment to identify actions to reduce vulnerability to both climate and non-climate threats. There may be several adaptation options to reduce vulnerability to climate change for a particular target resource; however, these options may vary in terms of cost, benefit, feasibility or effectiveness. This step focuses on identifying and evaluating adaptation options to include in a LEAP. The LEAP is intended to be a simple document that can be used to capture the actions a community wants to implement to address climate change impacts. It focuses on supporting communities to identify a set of adaptation measures that can be initiated by communities themselves to address climate change impacts. Some actions identified by the community may also be included that identify needs for additional resources or technical expertise, if those actions will significantly help reduce vulnerabilities. Communities may use the LEAP to help find support from external agencies and organizations that can assist with completing these actions.

Concepts and Terms

Adaptation Options: The range of actions that can be taken to reduce the vulnerability of a target resource to climate change. For a social resource target such as housing, adaptation options may include moving housing, developing new building standards, or retrofitting existing housing to withstand a climate threat. For natural resources targets such as coral reefs, adaptation options may include strengthening or expanding existing management efforts, including improving enforcement of an existing marine protected area or expanding protection to a network of marine protected areas. A quick reference guide to adaption options identified in the REAP-CCA is provided in Appendix B as a starting point for planning.

Local Early Action Plan (LEAP): A summary of the outputs of the four steps described in this guide. It includes a profile of the community, a Climate Story, an assessment of the vulnerability of target resources, and priority adaptation actions that a community wants to take to reduce its vulnerability to climate change. The LEAP can serve as a stand-alone document that can be used to support budget requests, or parts of it can be integrated into existing plans.

Maladaptation: An action implemented to reduce vulnerability to climate change that impacts adversely on or increases the vulnerability of other systems, sectors, or social groups (Barnett & O'Neill, 2010). It is important to consider what unintended or negative affects an action may have to the target or other resources. For example, building a seawall to protect a house may cause erosion that endangers other houses or an intact stand of mangroves further downshore.

Overview of Activities

The output of this step is a LEAP. The LEAP is a summary of outputs from all previous steps, from telling a community's Climate Story to describing adaptation measures to reduce vulnerability of priority target resources. This step is organized into the following activities:

Identify adaptation options (Activity 4.1). This activity focuses on identifying adaptation options for each target resource, building upon the results of the Vulnerability Assessment completed in Step Three. In this step, the CCA Planning Team evaluates each adaptation option for its effectiveness in

addressing climate and non-climate threats and for its implementation challenges. Adaptation options presented in the REAP-CCA are provided in Appendix B as a quick reference guide and to introduce the evaluation approach. An example of the evaluation matrix for a target resource is provided in Table 4.1.

Prioritize adaptation actions (Activity 4.2). This activity is focused on prioritizing adaptation options and developing an implementation schedule including the timing, responsibility, and resources needed for priority actions identified in Activity 4.1. An example implementation schedule plan for priority adaptation actions is provided in Table 4.2.

Develop a monitoring and evaluation approach (Activity 4.3). This activity provides factors to consider in developing a monitoring and evaluation approach to demonstrate the community's progress toward implementing its priority adaptation actions. The activity also provides an opportunity to consider how to monitor the effectiveness of the community's actions. Monitoring progress and evaluating the effectiveness of adaptation actions is an essential part of reducing risk to climate change and other hazards in the community. Monitoring and reporting can serve to catalyze ongoing local actions as well as to provide opportunities for recognition and support from outside the community. While this guide does not specifically provide guidance on effectiveness monitoring, evaluation benchmarks provided in Appendix C can be used to monitor implementation progress.

Finalize the LEAP (Activity 4.4). The CCA Planning Team will include the outputs of each step into a LEAP for the community to review. While the development of the LEAP in Activity 4.3 may remain a stand-alone document, this activity is intended to encourage the community and local government to integrate parts of the LEAP into existing plans as part of an implementation strategy. In addition, the community may need additional technical expertise to fully develop some of adaptation actions. The output of the four planning steps detailed in this guide can be used to seek additional input and resources that may be needed not only to implement priority adaptation actions, but also to conduct more in-depth planning and design of effective adaptation actions.

Community Experience: Timor-Leste

Timor-Leste communities are integrating local early actions to address climate threats as part of a comprehensive community development and natural resource management planning process. Working with government and local leaders and the US CTI Support Program, these communities identified priority target resources for improved marine resource management. The management actions identified

Planning for climate adaptation in Timor-Leste

Table 4.1 Example Evaluation of Adaptation Options for a Target Resource

ADAPTATION OPTIONS						
Target Resource: *Drinking Water* **Vulnerability Statement:** • *Drinking water resources from wells in the community are being degraded from overuse.* • *Climate-related droughts and coastal inundation from severe storms are expected to impact drinking water resources.* • *No other sources of drinking water are available to the community.*						
	FACTORS TO CONSIDER IN PRIORITIZING ADAPTATION OPTIONS					
Adaptation Options	Effectiveness		Cost/Benefit		Feasibility	
	To what extent does the action address non-climate threats and root causes?	To what extent does the action reduce vulnerability? (↓Exposure, ↓Sensitivity, ↑Adaptive Capacity)	To what extent does the action achieve multiple (social, ecological, and economic) benefits?	Are there any potential negative, unintended consequences of the action?	To what extent is the action feasible?	What is the capacity to implement the action?
Control the volume of water pumped from the community drinking- water well.	*Addresses root problem of saltwater intrusion in drinking water source.*	*Reduces sensitivity of drinking water wells to saltwater intrusion in the short-term, but increased sea-level rise and coastal inundation may still be a problem in the future.*	*By itself, this option might limit water use below what is needed to sustain the community.*	*None identified*	*Would need technical expertise to determine a way to establish the control system, and would require close monitoring to ensure the volume of water is controlled.*	*Community monitoring program can be established.*
Import water from another island.	*Addresses root problem of overuse of drinking water wells.*	*Reduces some vulnerability but makes the community reliant on others.*	*Costly in terms of financial resources and also reduces capacity to be self-reliant.*	*Could result in water shortages of another community.*	*It is feasible and is done in other smaller islands without drinking water sources.*	*Relatively costly solution*
Develop household water-catchment systems.	*Addresses root problem of overuse of drinking water wells.*	*Reduces vulnerability by creating an alternate water supply.*	*Achieves multiple benefits, increases self-reliance, is ecologically sound, and costs little.*	*Need to make sure that systems are properly operated to avoid contamination and resulting illness.*	*Need to make sure that the design is resistant to climate threats such as severe storms.*	*Relatively low-cost solution*

Table 4.2 Example Plan for Priority Adaptation Actions

Priority Adaptation Action Plan				
Target Resources	Priority Adaptation Actions	Timeframe	Lead and Partners	Resources or Support Needed
Drinking Water	*Establish community monitoring system and pumping limits to restore the quality of drinking water from wells.*	*Year 1-2*	*Village government, local university*	*Hydrological support to determine optimal pump rates considering climate projections. Education and outreach effort needed to promote best practices in water use.*
Drinking Water	*Develop household water catchment systems to provide additional drinking water capacity, especially during droughts.*	*Year 2-3*	*Households, local government*	*Engineering support to design safe and effective water catchment systems that are not vulnerable to climate change.*
Coral Reef	*Expand reforestation efforts in the watershed.*	*Year 1-3*	*Local and national government*	*Funding needed to expand reforestation and enforcement.*
Coral Reef	*Strengthen enforcement of fishing regulations.*	*Year 1-2*	*Community and local government*	*Funding needed for the watch tower.*

included the development of no-take zones and specific fisheries regulations to help restore the populations of the key important species. Once the communities had identified these key management actions, they focused on where to place no-take zones to include resiliency features and on what specific fisheries regulations would help rebuild key stocks.

The LEAP Guide was introduced after the main planning process had occurred with the communities. Climate change had not ranked high as a threat in these communities. As a result of outreach activities conducted using the LEAP Guide; changes in fish populations, coastal erosion, and sedimentation were identified threats that could worsen with increased climate impacts. Local early actions to address climate impacts included these:

- Design no-take zones and fisheries areas using the latest science-based management guidance to build resiliency contained in the biophysical principles for designing resilient networks of marine protected areas to integrate fisheries, biodiversity, and climate change objectives in the Coral Triangle (Fernandes et al., 2012).
- Re-vegetate key upland areas, particularly along water courses and coastal vegetation, to reduce sedimentation and coastal erosion.
- Strengthen water resource management systems.
- Diversify income sources, including development of small-scale tourism products and, possibly, seaweed culture.
- Use Fish Aggregation Devices during calm seasons.

The LEAP process gave communities the flexibility to integrate climate impacts into an ongoing planning process. The end result is that the communities and government have developed a set of management actions that will collectively build the health of coastal and marine resources while reducing vulnerability to climate change. By utilizing and adapting the LEAP process for communities in Timor-Leste, CCA was integrated into an existing community planning process in an effective and efficient way. (Case study provided courtesy of Candice Mohan and Rui Miguel de Silva Pinto of Conservation International.)

Activity 4.1 Identify Adaptation Options

In this activity, the CCA Planning Team will identify potential adaptation options to address climate and non-climate threats to each target resource which will then be validated by the community. There may be several different adaptation options that could address the vulnerability of the target resource. For instance, adaptation options for houses exposed to sea-level rise could include moving houses away from the coast, building a seawall to protect the houses, or raising the houses to reduce impacts. It is important to identify and evaluate options considering the effectiveness, cost of each adaptation option, possible benefits, and implementation challenges. Here are four key activities to identify adaptation options:

1. **Review the results of the Vulnerability Assessment.** Review all components of the Vulnerability Assessment that you completed in Step Three. Identify actions that address root causes, reduce exposure and sensitivity, and increase adaptive capacity.
2. **Evaluate current management strategies.** Evaluate current management strategies for effectiveness, their potential vulnerability to climate impacts, and their potential to support adaptation.
3. **Evaluate the effectiveness of current adaptation strategies.** Evaluate adaptation strategies used to address past hazard events. From Step Two, review the Historical Timeline and adaptation strategies. Are these strategies still being used? Are they effective?
4. **Identify new or refine existing adaptation actions to reduce vulnerability to climate impacts.** New or refined adaptation actions can be identified through community consultation and input from technical experts. In addition, Appendix B provides a list adaptation options based on the REAP-CCA and other sources of information.

List the adaptation options in the first column of Worksheet 4-1, and then describe each adaptation option in terms of effectiveness, cost/benefit, and feasibility. Questions to consider for each adaptation option are listed below, and responses can be summarized in Worksheet 4-1, "Adaptation Options." An example of the types of responses for the evaluation is provided in Table 4.1. The description of adaptation options in Appendix B will also help you think through the factors to characterize each adaptation option. You will have one of these worksheets for each target resource. It is recommended that this activity be completed by the CCA Planning Team with the technical capacity to address the specific target resource and then validated with the community.

Effectiveness

- Will the action achieve the desired results?
- Does the action address non-climate threats and root causes?
- Does the action reduce vulnerability? (↓Exposure, ↓Sensitivity, ↑Adaptive Capacity)

Cost/Benefit

- Will the action create more benefits than costs?
- Does the action achieve multiple (social, ecological, and economic) benefits?
- Are there any potential unintended or negative consequences (maladaptation) of the action to this resource or others?

Feasibility

- Is the action feasible?
- What is the level of community acceptance and commitment to implement adaptation actions?
- Is there strong leadership that supports adaptation?
- Are there legal barriers to implementing the adaptation action?
- Is there sustainable financing for adaptation actions?
- What is capacity (technical, financial) to implement the action?

Worksheet 4-1: Adaptation Options

ADAPTATION OPTIONS						
Target Resource: Vulnerability Statement:						
	FACTORS TO CONSIDER IN PRIORITIZING ADAPTATION OPTIONS					
Adaptation Options	Effectiveness		Cost/Benefit		Feasibility	
	To what extent does the action address non-climate threats and root causes?	To what extent does the action reduce vulnerability? (↓Exposure, ↓Sensitivity, ↑Adaptive Capacity)	To what extent does the action achieve multiple (social, ecological, and economic) benefits?	Are there any potential negative, unintended consequences of the action?	To what extent is the action feasible?	What is the capacity to implement the action?

Activity 4.2 Prioritize Adaptation Actions

Based on the adaptation options you identified and described in Activity 4.1, select the adaptation actions the community wants to implement. An adaptation action may be a high, medium, or low priority for the community. Even if the actions require extensive resources and support, it is still important to identify and include them in the plan because the community will need to work toward them to reduce vulnerabilities over time. Also be sure to include "quick wins" that the community can begin with little to no resources or support. These actions, although they may not do the most to reduce vulnerability, can help engage people and keep up things moving.

Review Worksheet 4-1, "Adaptation Options," and prioritize the actions in terms of effectiveness, cost/benefit, and feasibility (see Figure 4.1). List the priority adaptation actions on Worksheet 4-2, "Priority Adaptation Action Plan."

High priority actions. High priority actions are those that are highly likely to be effective because they address multiple threats and root causes of vulnerability that are urgent and severe. If nothing is done now, the impacts may not be reversible in the future and will have devastating consequences. High priority actions are also expected to achieve greater benefits than costs. These actions can be "win-win" solutions to multiple issues and are not anticipated to create unintended negative impacts.

Finally, high priority actions are those that are feasible. These actions are expected to have broad community acceptance and can be implemented with existing or obtainable technical and financial resources.

Medium priority actions. Medium priority actions address threats and root causes that are pressing but will not have the greatest impact in reducing vulnerability. These actions are important to consider but do not require immediate action.

Low priority actions. Low priority actions will have little impact on addressing the root cause of threats and vulnerability. These actions may be easy but will not build the resilience of the community and resources over time.

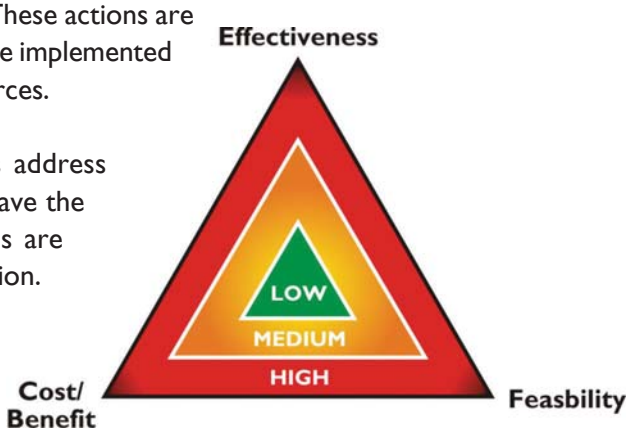

Figure 4.1 Model to prioritize adaptation options.

With the CCA Planning Team, develop the following implementation schedule for each priority adaptation action:

1. **Timeframe:** Specify when this action will be completed. Provide the month and year.
2. **Lead organization and partners:** Specify the organization and individual who will be responsible for completing this action. The lead organization and individual should be someone on the CCA Planning Team or another partner committed to making sure all tasks needed to implement the action are done. In addition, identify partner organizations that will be needed to assist in implementing the action and institutional structures through which adaptation might be mainstreamed. List all those involved and their role.
3. **Resources or support needed:** Specify any funds, technical expertise, equipment, political support, or other resources needed to ensure this action can be completed.

Once you have completed the "Priority Adaptation Actions and Implemetation Schedule" (Worksheet 4-2), integrate the table into the LEAP outline (Worksheet 4-3).

Worksheet 4-2: Priority Adaptation Actions and Implementation Schedule

Priority Adaptation Actions and Implementation Schedule				
Target Resource	Priority Adaptation Action	Timeframe	Lead and Partners	Resources or Support Needed

Activity 4.3 Develop a Monitoring and Evaluation Approach

Monitoring progress and evaluating the effectiveness of adaptation actions is an essential part of reducing risk to climate change and other hazards in the community. Monitoring and reporting on progress in implementing local early actions at local levels and national levels can catalyze ongoing local actions and provide opportunities for recognition and support from outside the community. Ultimately, the effectiveness of these adaptation actions need to be evaluated with respect to reducing a community's

vulnerability to climate change impacts. For an in-depth review and guidance on monitoring and evaluation of climate change adaptation see Ayers et al. (2012), Spearman and McGray (2011), and McKenzie et al. (2008). This activity draws upon these resources to discuss factors to consider when developing a monitoring and evaluation approach as part of your LEAP.

For this activity, the CCA Planning Team will need to review the outputs of each step and identify benchmarks and indicators that apply to monitoring progress and effectiveness. Some indicators may require baseline assessment in order to compare change over time.

Monitor the context for adaptation. In developing a Climate Story (Step Two) and conducting a Vulnerability Assessment (Step Three), the CCA Planning Team developed important baseline information to monitor the context for adaptation. In developing the Climate Story, the team mapped community resources and hazards, documented past and present hazards, and identified future climate threats. In conducting a Vulnerability Assessment, the team documented the exposure, sensitivity, and adaptive capacity of target resources to climate and non-climate threats. Monitoring the context for adaptation is important if the assumptions the team has made in adaptation planning based on these steps stays the same or changes over time. You can review the Climate Story and Vulnerability Assessment each year to answer these questions:

- Are seasons changing in the community?
- Is the frequency and severity of storms and flooding increasing?
- Is the frequency and severity of coral bleaching events increasing?
- Are there new non-climate threats emerging in the community that may affect the condition of target resources?
- What is the condition of target resources, and how are they changing over time? Is the trend in conditions the same or changing?
- Is the vulnerability of target resources changing? Is the exposure, sensitivity, and adaptive capacity of target resources and the community changing?

Monitor implementation progress. The implementation schedule for priority adaptation actions you developed in the previous activity can be used to monitor progress over time. You can review your implementation schedule to answer these questions:

- Is implementation on track? If not why not?
- Are the adaptation actions using resources effectively?
- Are there any changes in the climate and other contexts that should trigger adjustments to the implementation schedule?

The six Coral Triangle countries developed a CTI Monitoring and Evaluation (M&E) System with indicators to measure progress toward achieving the goals of the CTI-CFF RPOA. These indicators can be incorporated in your monitoring and evaluation approach. The indicator to monitor local implementation under "Goal 4: Climate Change Adaptation Measures Achieved" is:

- Percentage of local governments that have integrated climate adaptation into local governance (plans and actions)

This indicator will be monitored by using a CCA Benchmarking Tool provided in Appendix C. Benchmarks are a useful tool to monitor progress and guide local implementation of climate change adaptation. CCA benchmarks were included in the REAP-CCA (2011) to help identify the level and status of the

local government and community CCA efforts. Appendix C provides a checklist to determine whether the conditions of a particular benchmark have been met and to identify actions and tools needed to support achievement of the benchmark. If you have completed Steps 1 through 4 of the LEAP Guide and you have initiated at least two early adaptation actions, you will have completed the Level 1 benchmarks.

Evaluate effectiveness of adaptation actions. Ultimately, it is the effectiveness of adaptation actions in reducing vulnerability to climate change that must be evaluated. This part of the monitoring and evaluation approach requires that you establish baseline conditions and monitor change compared to the baseline over time. In selecting indicators that can be used to evaluate effectiveness of adaptation actions, you may consider the following questions:

- Are the adaptation actions the right ones?
- Is the adaptation action reducing vulnerability to climate threats?
- Are there any unanticipated negative consequences of the adaptation action?
- Does the adaptation action remain a priority of vulnerable communities and groups, or have priorities changed over time in response to a changing climate and other contexts?
- Is the adaptation action being implemented in a way that engages the appropriate stakeholders?
- Are the interventions supporting people to adapt and enabling people to make tangible and lasting changes in their adaptive capacity?

Activity 4.4 Finalize the LEAP

At this point, you should have all the information you need to complete the community LEAP. The CCA Planning Team has already been filling out several parts of the LEAP outline while completing the steps of this guide. Now simply complete any remaining sections, and the LEAP is done.

Once the team has completed the LEAP, be sure to ask local stakeholders for their input. Local stakeholder groups may include the local government, local institutions, churches, youth groups, women's groups, fishermen groups, and village tourism management boards. You may want to complete a formal adoption process, depending upon what is appropriate for the community.

Many communities already will have existing management plans or action plans to help guide their efforts to conserve resources and improve their communities. If the community already has a plan, whether it's informal or formal, integrate the results of the Vulnerability Assessment and priority adaptation actions into these existing plans. This will increase the plans' robustness in the face of climate change, reduce the likelihood of repetitive loss, better help the community cope with climate change impacts, and improve the likelihood of implementation.

1. With the CCA Planning Team, review existing management plan with a focus on objectives and actions.
2. Adjust or add objectives based on the results of the LEAP process.
3. Add any specific actions based on the results of the LEAP process.
4. Review the objectives and actions of the existing management plan, and ask the following questions:
    a. If we successfully pursue the actions we have outlined, will we achieve our objectives? If not, you may need to add additional actions or activities.

b. If we achieve all the objectives and/or actions we have outlined, will we overcome climate change threats and their root causes, reduce vulnerability to climate change impacts, and, as a result, improve the condition and resilience of target resources and the community? If you don't feel confident answering "yes," you should go back and decide if you need to develop additional objectives or actions.

If the community does not have a management plan, the LEAP can function as a management plan. If you need to develop a management plan to comply with government requirements, the LEAP can provide a lot of key information to be included in more formal management plans. Once you have updated the existing plan, the process is complete. Congratulations! Good luck implementing your plans.

Worksheet 4-3: Local Early Action Plan Outline

1. **Community Background** (Output of Step One)
   Summary Description (location, population size and characteristics, social and ecological resources and threats)

2. **Climate Story** (Output of Step Two)
   Community Map
   Historical Timeline
   Seasonal Calendar
   Indicators of a Changing Climate
   Target Resources and Status

3. **Vulnerability Assessment** (Output of Step Three)
   Vulnerability Assessment Summary for All Target Resources

4. **Priority Adaptation Actions and Implementation Schedule** (Output of Step Four)

Priority Adaptation Actions and Implementation Schedule				
Target Resource	Priority Action	Timeframe	Lead and Partners	Resources or Support Needed

5. **Monitoring and Evaluation Approach** (Output of Step Four)
   Indicators (baseline data, monitoring approach)

Appendices:
- Vulnerability Assessment Matrix by Target Resource (Target-specific outputs from Step Three)
- Adaptation Options Matrix by Target Resource (Target-specific outputs from Step Four)

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Appendix A
Beach Profiling (Emery Method)

Purpose: Beach profiling is a simple survey technique used to measure the contour of a beach. Very basic equipment, made from two 1.5-meter boards/poles (Emery boards) connected by a 3-meter rope, is used to create a line-of-sight with the horizon. The difference in elevation between the two poles defines the topographic change on that segment of the beach. The number resulting from this change is recorded as a single data point. These data points are recorded at regular intervals along the beach, from the frontal dune (or seawall) to the low-water mark. When these data points are connected, they create a graphic depiction of the contour of the beach, or the beach profile. A limitation of this method is its dependence on the visibility of the horizon. If clouds, fog, haze or rain obscure the horizon, then profiling should be rescheduled. Single-use cameras or digital cameras are also used to photograph the beach at a few established points every month. Long-term beach monitoring data is the first step to understanding complex beach processes. Using a series of profiles along abeach, the 1-meter contour can be estimated and used to visualize relative sea-level rise of 1-meter.

Participants: This exercise can be carried out by school students and community members. It is ideal to have one to two leaders who understand the method and who are part of the profiling team each time the monitoring is done so that it is carried out in a consistent manner.

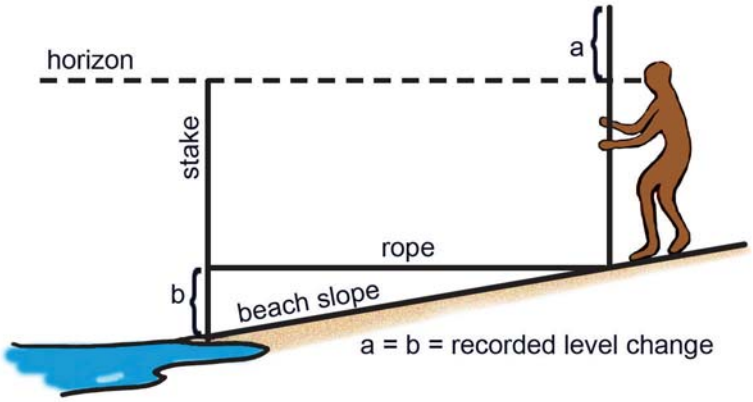
Materials needed: To build a set of **Emery boards**, you need two pieces of wood or bamboo poles of equal length and a rope of known length. (Boards/poles of 6 to 8 feet in length and approximately 3 meters of rope will work well.) Tie a loop in each end of the rope that can easily slide up and down the two boards/poles. Measuring down from the top of each board/pole, use a marker and a ruler to draw and label "graduations" (marks of equal length). It is recommended that System International units are used for the exercise; an appropriate graduation interval is every 2 centimeters. A small **level** is also helpful (though not necessary) to ensure that the rope is taut and level. Finally, you will need a **pen**, **paper** (datasheet), and **graph paper** or a computer spreadsheet program for recording and analyzing data.

Time requirement: The time necessary to profile will be dependent upon the expanse of beach and the experience level of those doing the profile. An hour or two may be necessary the first time, but subsequent profiles can be done more quickly. Also factor in time for the data to be processed and graphed.

Detailed Instructions: Emery Method for Beach Profiling

Instructions: Prior to beginning your shore profile, take a short walk along the beach and make qualitative observations about the shape of the beach. Identify prominent beach features including the dunes, vegetation line, wrack line/high water line, etc. Taking time to walk the beach without the worry of having to take an accurate measurement will help you interpret the quantitative data you collect while conducting your shore profile. Note how the beach has changed since your last visit. Does it appear to have eroded or accreted (grown)? Have there been human alterations? Select an area of beach that you want to profile. You might consider a number of sites in the community, areas where the beach seems to be eroding or growing, including areas near hardened shorelines (e.g., seawalls, bulkheads, rip-rap, groins, jetties).

A beach profile is a topographic transect measured perpendicular to the shoreline. Taking several shore profiles through time allows you to examine shoreline erosion and accretion trends and provides you with a means for assessing beach recovery after a storm.



You will measure beach profiles using the Emery technique, named after the person who applied this topographic measurement method to beach studies. It is simple and "low-tech" but accurate. A very important note of caution, however, is required: If a measurement error is made at one point, then all subsequent points along the profile will be offset by that amount of error. Therefore, take your time and double-check each reading. It is very disappointing to realize after returning from the field that your hard-earned data are erroneous.

This method was adapted from the North Carolina Coastal Reserve and National Estuarine Research Reserve's "Shore Profiles: A Field Exercise Examining Beach Topography and Coastal Processes."

1. **Find the starting point.** First, you will need to select and establish transect lines. These lines, where you will collect elevation measurements, are perpendicular to the water line. They may be evenly spaced along the beach or focused in areas of interest such as known erosional areas. In deciding how many transects to establish and where to establish them, keep in mind the available manpower to collect measurements, the time available per session, areas that warrant special attention, and the availability of permanent reference points. If a permanent landmark is not available, you will need to install reference points such as poles sunk into the sand, which will stay in place for future profile measurements. Take care that these points are at a sufficient distance from the water as to remain clear of high waves or high tides. Consider points that are beyond sand dunes or other upland features in relatively stable areas versus unstable areas. Once you have determined where your first transect line will be located, set a control point (a reference stake or pin) in the ground. *Remember: The same control point is reused for each subsequent profile and is the starting point of all measurements.* A second control point (stake or pin) or object (sometimes a utility pole, tree, chimney, etc.) should also be used. These two reference points define a line to follow to create a beach profile.

2. **Begin taking notes.** Include names of people in the team, the date, time, profile name or number, beach location, etc. on the datasheet.

3. **Record stake height.** Measure the height of the ground in relation to the top of the control point with the numbers (scale) up. The person holding the rod should stand off the profile line for the next step.

4. **Set rod 1.** Stand the end of one profile rod (rod 1) on the ground next to the control point with the numbers (scale) up. The person holding this rod should stand off the profile line for the next step.

5. **Set rod 2.** The second person takes rod 2 toward the ocean. Looking back toward land and rod 1, this person places rod 2 (with scale up) on the profile line using the control points as a guide. Pick a horizontal distance of a meter (or other suitable distance if obstacles are in the way) as a spacing between the two poles. Use a graduated chain or pole to do this, and be careful to hold both poles straight up and down while setting rod 2 in place.

6. **Measure and record.** From the landward pole, the first person sights the horizon and the top of the lower of the two rods. This line-of-sight will intersect partway up the other rod. Read the elevation number marked on the other rod that is in line with the pole top and the horizon. *Keep both poles vertical when reading!* Note that sometimes the reading will come from rod 1 and sometimes from rod 2. This is because the ground may slope down or up and may change which pole is higher at different places on the beach profile line. When the ground slopes down toward the ocean, the forward rod (rod 2) will be lower, and a negative [-] number is assigned to the vertical reading off of rod 1. When the ground slopes up looking toward the ocean, the forward rod will be higher, and a positive [+] number is assigned to the reading. In this case, the number is read off the forward rod (rod 2). So moving forward on the profile, uphill is [+] and downhill is [-]. Always use either a "+"or "-" before the number. It takes careful attention to get this right on each measurement. A single error will make the rest of the data plot incorrectly on a graph. Record the elevation change and horizontal distance between poles on the log sheet. Also note any features at the forward rod (such as edge of dune, slope change, water line, etc.) in the "notes" column on the datasheet.

7. **Move ahead.** After the notes are taken, move rod 1 to the same "footprint" occupied by rod 2. The person at rod 2 should wait for rod 1 to come up alongside rod 2 in order to be certain of getting the position correct. After rod 1 is in the place of rod 2, the forward rod can be moved ahead another meter or two and placed on the ground in line with rod 1 and the original control point(s). The job of the lead person is to be sure each forward move stays on the line. Rod 2 must be set down on the ground, keeping the chain (or other tape measure) level.

8. **Repeat steps 6 and 7. Measure, record, and move.** Continue to move ahead, repeating these steps all the way to the water. As you go, everyone on the team should look ahead for features to stop on and measure. If some feature – perhaps the edge of the dune – does not occur at a horizontal interval of 1meter, then make the horizontal distance smaller. For example, if the dune edge is only 0.6 meter from the least measurement, move the forward pole ahead only that far. On the next measurement, move ahead only 0.4 (or 1.4) meter in order to get back on a spacing of 1-meter intervals. Keeping a set interval in whole meters will help with data analysis later.

9. **Stop at the water.** Make a measurement that includes the water line. In the "Notes" column of the datasheet, abbreviate it "W.L.," and record the time it was measured. Because the height of the tide is changing, the time of the reading is important. Estimate the place on the beach where the water level would be without the waves, the still-water level. There is no need to measure how far up the beach the swash is going at the time of the measurement.

10. **Continue on (optional).** The process can be continued into the water if teams want to. This is optional and not necessary. Do not take chances. *Always keep your personal safety and that of your team members in mind.* A few extra points on a graph are not worth the risk of personal injury.

11. **Conduct the final reading.** At the last measurement, record the time in the "Notes" column on the datasheet.

12. **Photograph the beach.** Take three photographs of the beach. It helps to place the profile rods down on the profile line partway up the beach, near the high tide line. Stepping back from the rods, take a picture looking up to the dune (or seawall) from a spot near the water line. Move up about halfway on the profile and take two more pictures: one looking each way along the beach (parallel to the water line). For these shots, try to include the profile rods in the foreground. Frame the picture to include the beach from dune (seawall) to the water.

13. **Pack up.** Gather up all the gear, including any posts back at the control points, notes, and field gear. The profile is done!

Checklist for Beach Profiling Activity

Weather and Safety Requirements

- Is the horizon visible?
- Is the weather safe for profiling? Safety is the first priority.
- Profiling dates can be flexible if conditions do not allow safe, accurate profiling.

Tips for Recording Your Data on Paper and in Pictures

- Develop a datasheet before you go out to do the profile. Don't forget the units you are working in (centimeter for vertical; meter for horizontal).
- Make your first measurement from the front stake. This will be the first vertical data point, with zero as the horizontal point. Remember that the back stake is a "backup" if you lose the front.
- When recording measurements, remember that downhill is negative and uphill is positive.
- As you are moving down the line of profile, keep notes of anything unusual or something that is not easily identifiable from the profile logs (for example, the high tide line).
- Draw a rough sketch of each profile, noting significant features on the back of your datasheet.

After Profiling

- You may make a copy for your team to keep if you would like.
- If using a digital camera to take pictures of the beach, name your pictures appropriately.

Processing Profile Data

Using the data of the beach profiles, plot the cumulative vertical elevations (y-axis) as a function of horizontal position (x-axis). This will reveal the actual beach profile. It will also be valuable to plot the slope against the horizontal position as a measure of steepness. Slope is calculated by dividing the difference in elevation between any two adjacent points by the difference in horizontal distance between those two points. Remember, the units of elevation and distance must be consistent, so you'll likely have to convert centimeters to meters.

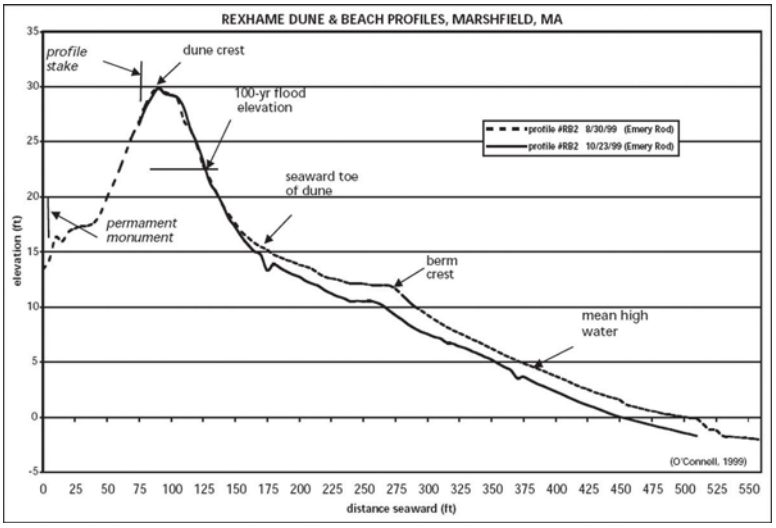
If the beach profiled has a gentle slope, the profile data may not appear to be very exciting – like a horizontal line if the horizontal and vertical scales are equal. This provides an opportunity to employ a common technique of geologists, geographers, and cartographers called "vertical exaggeration." To employ vertical exaggeration, simply alter the vertical scale by a chosen factor (for example, a factor of 10) to accentuate subtle topographic features.

Beach Profile Datasheet

Site: _____ Date: _____ Time start: _____ Time finish: _____

Lower Pole Measurement (cm)	Upper Pole Measurement (cm)	Vertical Distance= L-U (cm)	Horizontal Distance (m)	Notes

As more profiles are completed over time, they can be added to the same graph to show changes over time (see example below).



The example beach profile above is from Woods Hole Oceanographic Institution Sea Grant Program (O'Connell, 2000). Changes in the profile of a beach can be the result of many things that can be compounded by climate change and sea-level rise. These include man-made structures (docks, jetties, sea walls, etc.); large storm events; natural shoreline migration such as that which occurs on barrier islands; seasonal changes in currents and wave action, which can result in seasonal erosion and deposition patterns; etc. When trying to interpret changes in beach profiles over time, consider consulting local experts (academic institutions, local natural resource managers, etc.) to assist the community in understanding beach dynamics and climate and non-climate impacts.

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Appendix B
List of Potential Adaptation Options: Benefits and Implementation Challenges

This initial list of potential adaptation options is intended to provide ideas to reduce the vulnerability of target resources to climate change impacts and other coastal hazards. Many of the options are drawn from the *Region-wide Early Action Plan for Climate Change Adaptation for the Nearshore Marine and Coastal Environment and Small Island Ecosystems* (CTI-CFF, 2011). These options were identified by the six Coral Triangle countries to achieve "Goal 4: Climate Change Adaptation Measures Achieved," of the Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security (CTI-CFF) Regional Plan of Action (RPOA). Other sources of information were used to augment this list. It is not a comprehensive list but a starting point. A description of potential socioeconomic, ecological, and governance benefits and implementation challenges is provided for each adaptation option. These benefits and implementation challenges are intended to assist with prioritizing options and initiating a careful review of each adaptation option to minimize the likelihood of unintended negative consequences or maladaptation.

Potential Adaptation Options for Coastal Fisheries

Early Adaptation Options	Climate Threat Addressed	Potential Benefits, Negative Consequences, and Implementation Considerations		
		Social-Economic	Ecological	Governance
• Establish and strengthen early warning systems for coastal mariners. • Improve hazard detection and warning communications. • Prepare mariners with capacity to respond.	• All threats, especially increased intensity and severity of severe storms	• Warns mariners of tsunami, severe storms, erosion, and other dangerous conditions	• Reduces economic losses through early warning and appropriate action	• Funding is needed to establish, test, and maintain early warning systems. • Preparedness training for mariners is needed to raise awareness of appropriate responses to warnings.
Safeguard critical habitats that produce fish, including wetlands, mangroves, coral reefs, and lagoons. • Manage and restore vegetation in watersheds. • Protect and rehabilitate habitats critical to fisheries production. • Provide for landward migration of coastal fish habitats. • Allow expansion of freshwater habitats.	• Increased siltation and nutrient loading from heavy rainfall • Sea-level rise and changes in fisheries production and availability resulting from changes in oceanographic conditions	• Provides food security through sustainable fisheries • May limit areas where fishing occurs now	• Protects nursery grounds for fisheries • Maintains ecosystem structure and function	• Regulations need to be established and enforced.
• Optimize catches from coastal demersal and freshwater fish stocks. • Sustain production of coastal demersal fish and invertebrates. • Diversify catches of coastal demersal fish.	• Changes in fisheries productivity and availability resulting from changes in oceanographic conditions	• Increases catches and profits from a healthier fishery • Provides food security through sustainable fisheries • Manages resource use conflicts	• Improves health of fish stocks	• Regulations need to be established and enforced.

Early Adaptation Options	Climate Threat Addressed	Potential Benefits, Negative Consequences, and Implementation Considerations		
		Social-Economic	Ecological	Governance
• Manage freshwater and estuarine fisheries to harness opportunities.		• May create unemployment and displacement		
• Establish comprehensive pollution prevention measures from land-based sources of pollution to rivers and coastal waters and monitor seafood safety.	• Increased introduction of nutrients and pathogens resulting from severe storms and flooding, causing harmful algal blooms and water-borne diseases	• Reduces risk to human health and safety	• Reduces nutrients and pathogens entering waterways and contaminating fisheries	• Monitoring and early warning systems are needed to minimize impacts to human health and safety.
• Develop pond aquaculture for tilapia, carp, or milkfish to diversify supply of fish.	• Changes in marine fisheries production and availability resulting from changes in oceanographic conditions	• Provides protein source other than from marine fish • Simple, proven technology available for some species • Availability of suitable feeds may be limiting.	• Reduces pressure on capture fisheries • Impacts to freshwater biodiversity from fish escaping ponds • Environmental impacts of aquaculture are well documented and need to be mitigated.	• Regulations and best practices for sustainable aquaculture need to be established and enforced. • Training and technical assistance may be needed to design and operate.
• Relocate, retrofit, or explore new fisheries-related infrastructure and assets-related processing and marketing technologies.	• Sea-level rise, severe storms	• Changes in processing infrastructure and marketing may be required.	• Fisheries-related infrastructure should be designed and located in a manner that minimizes environmental impacts to sensitive coastal habitats.	• Climate change scenarios need to be integrated into the design and location of fisheries-related infrastructure.

References:

Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security (CTI-CFF). (2011). Region-wide early action plan for climate change adaptation for the nearshore marine and coastal environment and small island ecosystems (REAP-CCA). Adopted at the 7th CTI Senior Officials Meeting in Jakarta, Indonesia, October 2011. Prepared by the CTI-CFF CCA Technical Working Group with assistance from the US CTI Support Program and the CTI Interim Regional Secretariat, Jakarta, Indonesia.

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Potential Adaptation Options for Marine and Coastal Habitats

Early Adaptation Options	Climate Threat Addressed	Potential Benefits, Negative Consequences, and Implementation Considerations		
		Social-Economic	Ecological	Governance
MANGROVES				
• Improve management of existing mangroves. • Reduce human impacts on mangroves. • Foster mangrove green shields. • Improve legislation and local management. • Establish strategic mangrove protected areas.	• Rising sea level, increased waves and wind resulting from extreme storms, increased air and sea temperature, changes in sedimentation resulting from extreme rainfall or drought	• Increases food security by protecting nursery grounds for coastal fisheries • Protects community from tsunami, severe storms, and other coastal hazards or flooding events • Need to provide access to alternative cooking fuels and other non-extractive livelihood alternatives such as beekeeping or crab fattening to reduce harvesting of mangrove forests	• Reduces sedimentation on coral reefs and in other coastal habitats • Maintains diverse mangrove species for biodiversity conservation • Provides nursery grounds for coastal fisheries	• Provides carbon sink to support climate mitigation
• Establish strategic mangrove protected areas. • Protect mangrove mother trees. • Protect pristine mangrove forests and mangrove areas near or adjacent to known areas of abundant fish, mollusk, and crustacean fisheries.	• Rising sea level, increased waves and wind resulting from extreme storms, increased air and sea temperature, changes in sedimentation resulting from extreme rainfall or drought	• Increases food security by protecting nursery grounds for coastal fisheries • Protects community from tsunami, severe storms, and other coastal hazards or flooding events • Need to provide access to alternative cooking fuels and other non-extractive livelihood alternatives such as beekeeping or crab fattening to reduce harvesting of mangrove forests	• Reduces sedimentation on coral reefs and in other coastal habitats • Maintains diverse mangrove species for biodiversity conservation • Provides nursery grounds for coastal fisheries	• Provides carbon sink to support climate mitigation

Early Adaptation Options	Climate Threat Addressed	Potential Benefits, Negative Consequences, and Implementation Considerations		
		Social-Economic	Ecological	Governance
• Rehabilitate existing mangrove areas and reforest abandoned fishponds. • Select "climate-smart" mangrove species. • Use appropriate replanting practices. • Establish nursery to raise seedlings.	• Rising sea level, increased waves and wind resulting from extreme storms, increased air and sea temperature, changes in sedimentation resulting from extreme rainfall or drought	• Protects coastal communities from storm surge and other hazards • Provides alternative livelihoods	• Provides nursery grounds for fisheries • Protects coral reefs from sedimentation from upland sources • Sequesters carbon in support of climate mitigation	• Community-based natural resource management need to be strengthened to sustainably manage mangroves and other natural resources. • Policies on reverting abandoned fishponds needs to be established and implemented.
• Plan for inland migration of mangrove areas. • Use sea-level projections to identify coastal inundation areas. • Limit human settlement in these areas.	• Rising sea level	• Mangroves buffer coastal communities from storm surge and other hazards. • Relocation of communities may be needed to allow landward migration.	• Mangroves' benefits such as providing nursery grounds for fisheries, protecting coral reefs from sedimentation from upland sources, and sequestering carbon to support climate mitigation are preserved.	• Land-use policies need to restrict development and be enforced.
• Manage for mangrove accretion. • Design shore structures to allow long-shore sediment drift, which is an important source of sediment for mangroves in downstream areas. • Maintain tidal hydrology of mangrove ecosystems through the use of sound engineering designs such as culverts and trestle	• Rising sea level, changes in sedimentation resulting from extreme rainfall or drought	• Mangroves buffer coastal communities from storm surge and other hazards.	• Protects natural tidal hydrology needed to maintain healthy mangrove ecosystems and nursery grounds	• Environmental impact analysis should be conducted for transportation projects adjacent to mangrove areas.

Early Adaptation Options	Climate Threat Addressed	Potential Benefits, Negative Consequences, and Implementation Considerations		
		Social-Economic	Ecological	Governance
bridges to allow downstream transport of sediment. • Prohibit sediment removal or dredging from areas that are a source of sediment to mangrove areas.				
CORAL REEFS				
• Effectively manage MPAs — particularly no-take reserves — for the long term (>20 years), preferably permanently.	• Increased sea surface temperature and ocean acidification	• Protects community from tsunami, severe storms, erosion, and other coastal hazards	• Coral reef habitat to support biodiversity conservation and coastal fisheries	• Existing marine spatial use zones and marine protected area regulations need to be monitored and enforced.
• Prohibit coral harvesting or destruction through any other means.	• Increased sea surface temperature and ocean acidification	• Protects coral reef habitat to protect the community from tsunami, severe storms, erosion, and other coastal hazards • Need to develop and promote use of alternatives to coral for lime production	• Increases resilience of coral reefs from ocean acidification and sea-surface temperature anomalies	• Regulations need to be in place with thecapacity to enforce prohibitions.
• Establish networks of MPAs designed for resilience. • Establish large, multiple-use MPAs that include but are not limited to networks of no-take reserves (areas of ocean that are protected from extractive and destructive activities). • Designate at least 20% of each habitat type as no-take reserves.	• Increased sea surface temperature and ocean acidification	• Protects coral reef habitat to protect the community from tsunami, severe storms, erosion, and other coastal hazards	• Improves adaptive capacity of coral reefs from ocean acidification and sea-surface temperature anomalies • Ecological assessments need to be conducted to guide marine protected area establishment for greatest ecosystem benefit.	• New marine spatial use zones and marine protected area regulations need to be established, monitored, and enforced.

Early Adaptation Options	Climate Threat Addressed	Potential Benefits, Negative Consequences, and Implementation Considerations		
		Social-Economic	Ecological	Governance
• Designate multiple examples (at least three) of each habitat type as no-take reserves. • Protect key reproduction areas (e.g., spawning, feeding, and nursery areas). • Apply minimum sizes to MPAs — particularly no-take reserves (depending on key species and how far they move). • Separate MPAs — particularly no-take reserves — by minimum and variable distances (<10-20 km). • Protect habitats known or thought to be resistant to climate change impacts.				

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Potential Adaptation Options for Livelihoods and Economic Development

Early Adaptation Options	Climate Threat Addressed	Potential Benefits, Negative Consequences, and Implementation Considerations		
		Social-Economic	Ecological	Governance
• Develop emergency response and recovery plans for businesses.	• Severe storms and other threats	• Accelerates recovery and resumption of economy	• Minimizes unintended environmental impacts during disaster recovery through proper planning	• Training, funding, and other incentives are needed to promote disaster preparedness within the private sector.
• Establish greenbelts to protect businesses and tourism industry along rivers and the coastal zone.	• Riverine and coastal flooding	• Protects community from tsunami, severe storms, erosion, and other coastal threats • Provides public recreational areas	• Protects coastal forests, sand dunes, and other natural features	• Land-use policies need to restrict development in greenbelts.
• Diversify livelihoods and build equitable access to markets for products and services to provide alternatives to communities dependent on fisheries and other coastal resources.	• Decline in coastal resources and changes in fish distribution resulting from climate impacts on oceanography and marine productivity	• Reduces economic losses associated with single industry-dependent communities	• Impacts of livelihood alternatives on natural resources and the environment needs to be considered.	• Environmental impact analysis should be conducted for new economic development.
• Diversify agricultural products with climate-resilient crops.	• Changes in precipitation patterns resulting in drought, heavy rainfall	• Reduces economic losses associated with agriculture	• Impacts of livelihood alternatives on natural resources and the environment need to be considered.	• Feasibility studies for new agricultural products should be conducted using climate change scenarios.

References:

Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security (CTI-CFF). (2011). Region-wide early action plan for climate change adaptation for the nearshore marine and coastal environment and small island ecosystems (REAP-CCA). Adopted at the 7th CTI Senior Officials Meeting in Jakarta, Indonesia, October 2011. Prepared by the CTI-CFF CCA Technical Working Group with assistance from the US CTI Support Program and the CTI Interim Regional Secretariat, Jakarta, Indonesia.

Potential Adaptation Options for Social Services and Infrastructure

Early Adaptation Options	Climate Threat Addressed	Potential Benefits, Negative Consequences, and Implementation Considerations		
		Social-Economic	Ecological	Governance
POPULATION AND SOCIAL SERVICES				
• Establish and strengthen early warning system for all hazards – natural and climate change–related. • Improve hazard detection and warning communications. • Prepare community to respond.	• All threats, especially increased intensity and severity of storms	• Warns community of tsunami, severe storms, erosion, and other dangerous conditions	• Reduces economic losses through early warning and appropriate action	• Funding is needed to establish, test, and maintain early warning systems.
• Establish community-based disaster management programs to respond and recover from hazard events.	• All threats, especially increased intensity and severity of storms	• Prepares the community to respond to disasters and recover quickly • Private sector should be engaged in community-based disaster management programs to accelerate restoration of businesses.	• Minimizes unintended environmental impacts through pre-disaster recovery planning • Debris management plans need to protect sensitive habitats.	• Allows emergency response agencies to focus efforts on most vulnerable population and restoring public services
• Establish coastal set-backs and other land-use zones to locate coastal development outside of hazard-prone areas.	• Sea-level rise and coastal inundation	• Protects coastal communities from severe storms, sea-level rise, and other hazards • May impact accessibility to coastal areas and livelihoods	• Protects coastal forests, sand dunes, and other natural features	• Land-use policies need to be established and enforced.
• Manage water demand through water reuse, recycling, rainwater harvesting, desalination, or other methods.	• Changes in precipitation resulting in periods of intense drought or flooding	• Provides sustainable water resources to communities, agriculture, and businesses	• Need to protect water resources required to sustain river and stream base flows and support aquatic life.	• Climate change scenarios for water resources need to be integrated into existing local development policies and plans.

Early Adaptation Options	Climate Threat Addressed	Potential Benefits, Negative Consequences, and Implementation Considerations		
		Social-Economic	Ecological	Governance
• Promote household gardens and water harvesting systems to enhance community self-sufficiency.	• Changes in precipitation resulting in periods of intense drought or flooding	• Protects coastal communities from impacts of climate change	• Need to ensure that harmful pesticides are not used	• Training and support may be needed to learn techniques and provide materials.
• Identify agriculture and aquaculture products that are less prone to climate impacts.	• Changes in precipitation patterns resulting in drought, heavy rainfall	• Markets for new products need to be carefully analyzed and market linkages established.	• Need to ensure that environmentally friendly agriculture practices are used and ensure that harmful pesticides are not used	• Training may be needed to introduce new products.
• Prohibit sand mining of small, low-lying islands.	• Sea-level rise, king tides, and coastal erosion	• Protects coastal communities on low-lying islands from impacts of climate change	• Protects sensitive coastal habitats	• Regulations need to be in place with the capacity to enforce prohibition.
• Develop relocation strategies for highly vulnerable communities.	• Sea-level rise, king tides, and coastal erosion	• Severs social and cultural ties with place	• Ensure that sensitive ecosystems are not destroyed through relocation	• Need to ensure that relocation does not place communities at risk from other hazards.
• Develop emergency response and recovery plans for public services.	• Severe storms and other threats	• Accelerates response and recovery in response in disaster conditions	• Reduces unintended environmental impacts resulting from redevelopment in sensitive environments and disposal of disaster-related debris	• Plans should be developed through a multisectoral process and regularly exercised.
COMMUNITY INFRASTRUCTURE				
• Retrofit existing critical infrastructure to withstand climate change and other natural hazard impacts.	• Sea-level rise, increased intensity and severity of severe storms	• Reduces disruption to basic services • Reduces risk to individuals and public	• Retrofitting should consider incorporating green technology.	• Building codes should be reviewed and revised to incorporate climate scenarios, and then should be enforced.

Early Adaptation Options	Climate Threat Addressed	Potential Benefits, Negative Consequences, and Implementation Considerations		
		Social-Economic	Ecological	Governance
• Establish coastal set-backs and other land-use zones to locate new critical infrastructure development outside of hazard-prone areas.	• Sea-level rise and coastal inundation	• Reduces disruption to basic services • May impact public accessibility	• Protects coastal forests, sand dunes, and other natural features	• Land-use policies need to be established and enforced.
• Protect critical infrastructure using seawalls and offshore buffers	• Sea-level rise and coastal inundation	• Reduces disruption to basic services • Protection efforts may be short-lived, depending on severity of climate impacts. • May be costly to implement	• Increases coastal erosion and should be considered only if no other options are available	• Seawalls and offshore buffers should be considered only after assessment of vulnerability and careful evaluation of adaptation options are conducted.

References:

Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security (CTI-CFF). (2011). Region-wide early action plan for climate change adaptation for the nearshore marine and coastal environment and small island ecosystems (REAP-CCA). Adopted at the 7th CTI Senior Officials Meeting in Jakarta, Indonesia, October 2011. Prepared by the CTI-CFF CCA Technical Working Group with assistance from the US CTI Support Program and the CTI Interim Regional Secretariat, Jakarta, Indonesia.

Appendix C
Benchmarking Progress in Adapting to Climate Change

Benchmarking can provide useful baseline information that can be monitored over time. The CCA Benchmarking Tool is designed to support benchmarks included in the REAP-CCA. The tool is intended to be used by local governments and community CCA planning teams that have taken on the responsibility of overseeing the climate change adaptation planning and implementation process. National government agencies and assisting organizations can also use this tool to assess the status of adaptation efforts, identify gaps, and prioritize capacity development needs to support local adaptation planning. These benchmarks are also included in the CTI Monitoring and Evaluation System.

The benchmarks should be evaluated by the local team that is facilitating the process for the community or local government to incorporate climate change adaptation into local policies, plans, and programs. The benchmarks can be used to assess current status, guide planning efforts, and monitor performance.

The baseline status of climate adaptation in a community can be assessed by reviewing the descriptions of benchmarks and determining which benchmark has been achieved and at what level. If you are unsure, review the description of that benchmark to gain a better understanding of what is involved. The benchmarks can also serve as a guide to planning next steps in adapting to climate change by determining which benchmarks have not been addressed. Finally, the benchmarks can be used to monitor implementation and compare progress against the baseline assessment.

Benchmarks for Measuring Progress in Climate Change Adaptation in the Coral Triangle

Level 1 – Getting Started	Level 2 – Laying a Solid Foundation	Level 3 – Responding to Changing Conditions
Objective: Awareness of climate impacts and vulnerability with early adaptation actions initiated	**Objective:** Climate adaptation integrated into plans and programs with regular funding allocated to sustain implementation of early adaptation actions with monitoring	**Objective:** Climate adaptation mainstreamed into policies, plans, programs, and decision-making processes across all sectors with monitoring, results, and positive returns
☐ CCA planning team organized and trained to facilitate local early action planning ☐ Community outreach on climate change issues and early actions conducted ☐ Local climate vulnerability assessment (qualitative) conducted ☐ Indicators (social and natural) of climate impacts and adaptation actions identified and baseline assessments conducted ☐ Timeline for implementation of early adaptation actions developed ☐ At least two early adaptation actions planned and initiated	☐ Local partnerships established to support adaptation ☐ Stakeholder outreach on local early adaptation plans and adaptation conducted ☐ Local climate vulnerability assessment updated and refined (quantitative) ☐ Early actions and timeline for implementation reviewed and updated ☐ Local early actions incorporated into plans and programs ☐ At least four early adaptation actions implemented with success ☐ Monitoring of climate impacts and effectiveness of adaptation strategies conducted	☐ National, regional, and international partnerships established to support long-term adaptation ☐ CCA mainstreamed into policies, plans, and programs ☐ At least six early adaptation actions implemented with success ☐ Monitoring of climate impacts and effectiveness of adaptation strategies conducted to adapt and improve management

Checklist for Level 1: Getting Started

Level 1 - Getting Started Objective: Awareness of climate impacts and vulnerability with early adaptation actions initiated		
Benchmarks for Local Implementation	**Description**	**Selected Guides and Tools**
☐ CCA planning team organized and trained to facilitate local early action planning	***Is there an established group of people who will plan and implement early actions for climate adaptation?*** The CCA planning team should be a multisectoral and multidisciplinary group that can support the integration of early actions on climate adaptation into existing/new local plans, policies, and programs. The team may be an existing body or a new one depending on the local situation and needs. An illustrative team composition may include a local planning officer, finance officer, and sectorial specialists. The team should include representatives from government, nongovernmental organizations, and the private sector and should represent a balance of gender and social groups in the community. The team or members of the team should have some training or orientation on climate change issues and adaptation strategies.	LEAP Guide – Step One
☐ Community outreach on climate change issues and early actions conducted	***Is the community aware of climate change and impacts?*** Community education and outreach should cover the following topics: (1) What is climate change? (2) How does it impact our lives? (3) What can be done to adapt to climate change? Education and outreach activities may include community or village meetings, orientations, inclusion in school curriculum or special school presentations, outreach materials, and activities to illustrate the impacts of climate change.	LEAP Guide – Step Two Adapting to a Changing Climate (flipchart, booklet, and facilitator's notes) (Gombos et al., 2010)
☐ Local climate vulnerability assessment (qualitative) conducted	***What are the observed and potential impacts of climate change in our community?*** A qualitative vulnerability assessment can provide important information about climate impacts in the community. Assessing vulnerability involves identifying the degree of exposure and sensitivity of people, natural resources, and the built environment to climate impacts and the capacity of the these resources to adapt climate change.	LEAP Guide – Step Three Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change (Bell et al., 2011) Climate Change Vulnerability Assessment and Adaptation Planning for Mangrove Systems (Ellison, 2012)

Level 1 - Getting Started		
Benchmarks for Local Implementation	**Description**	**Selected Guides and Tools**
☐ Indicators (social and natural) of climate impacts and adaptation actions identified and baseline assessments conducted	*What indicators of climate change should be monitored locally?* Indicators and baseline conditions need to be established in order to monitor change over time. Monitoring change in one or more variables can provide valuable information toward understanding the changing conditions and impacts of climate change. Local universities can provide assistance in establishing sentinel sites, monitoring key variables, and reporting results. Some of the variables will require specific technology and standardized methods to monitor such as sea surface temperature and ocean acidification. Other variables such as location and extent of coastal flooding may be monitored by communities following simple protocols.	LEAP Guide – Steps Two, Three, Four, and Appendix A Participatory Monitoring, Evaluation, Reflection and Learning for Community-based Adaptation: A Manual for Local Practitioners (Ayers et al., 2012) Making Adaptation Count: Concepts and Options for Monitoring and Evaluation of Climate Change Adaptation (Spearman and McGray, 2011) Desk Review: Evaluation of Adaptation to Climate Change from a Development Perspective (Hedger et al., 2008)
☐ Timeline for implementation of early adaptation actions developed	*What early actions should be taken to reduce vulnerability?* Early actions encompass a broad range of best practices designed to build coastal community resilience to climate change. Early actions may include discrete actions to reduce exposure (e.g., establishing coastal setbacks for new development); reduce sensitivity (e.g., reduce non-climate stressors such as overfishing and pollution); and increase adaptive capacity (e.g., establishing early warning systems for disaster management). A timeline of early actions provides a phased implementation approach and highlights priorities that should be initiated.	LEAP Guide – Step Four; Appendix B Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change (Bell et al., 2011) Climate Change Vulnerability Assessment and Adaptation Planning for Mangrove Systems (Ellison, 2012) Biophysical Principles for Designing Resilient Networks of Marine Protected Areas to Integrate Fisheries, Biodiversity and Climate Change

Level 1 - Getting Started		
Benchmarks for Local Implementation	**Description**	**Selected Guides and Tools**
		Objectives in the Coral Triangle (Fernandes et al., 2012) Draft Principles and Guidelines for Integrating Ecosystem-based Approaches to Adaptation in Project and Policy Design (Andrade et al., 2011)
☐ At least two early adaptation actions planned and initiated	***What early adaptation actions should we initiate?*** Early adaptation actions are designed to address the dual goals of sustainable development and risk reduction. This means balancing social, economic, and environmental objectives and reducing risk from climate change and other hazards. Early adaptation actions should meet these objectives through design and implementation.	LEAP Guide – Appendix B Adapting to Coastal Climate Change: A Guidebook for Development Planners (Coastal Resources Center at the University of Rhode Island, 2009) Locally-Managed Marine Areas: A Guide to Supporting Community-based Adaptive Management (Govan et al., 2008) Principles and Practice of Ecosystem-based Management: A Guide for Conservation Practitioners in the Tropical Western Tropical Pacific (Clarke and Jupiter, 2010) Draft Principles and Guidelines for Integrating Ecosystem-based Approaches to Adaptation in Project and Policy Design (Andrade et al., 2011)

Checklist for Level 2: Laying a Solid Foundation

Level 2 – Laying a Solid Foundation Objective: Climate adaptation actions integrated into plans and programs with regular funding allocated to sustain implementation of early adaptation actions with monitoring		
Benchmarks for Local Implementation	**Description**	**Selected Guides and Tools**
☐ Local partnerships established to support adaptation	***What types of partnerships should be explored?*** Collaboration between different levels of government, private sector, academic institutions, and nongovernmental organizations is needed to build coastal community resilience to climate change. Government agencies, nongovernmental organizations, and academic institutions can by tapped to provide training and technical and financial assistance to develop, implement, and monitor efforts in sustainable development, coastal resource and fisheries management, emergency response, and risk assessment. Examples of resilience-building best practices that require collaboration and partnerships include scaling up marine protected area management to a marine protected area network or fisheries management unit; addressing vulnerability of major roads, ports, and harbors to climate change; or establishing early warning systems for climate change and hazard conditions.	Public-Private-Partnership Handbook (Asian Development Bank, 2008)
☐ Stakeholder outreach on local early adaptation plans and adaptation actions conducted	***Why conduct outreach to stakeholders on local early adaptation plans?*** Adaptation actions may have far-reaching implications on social and cultural ties and may impact livelihoods. Stakeholders need to be engaged in reviewing adaptation options and providing input to improve implementation. Engaged stakeholders should include people with economic and social interests in the resources, minority groups, and both men and women.	LEAP Guide – Step Two
☐ Local climate vulnerability assessment updated and refined (quantitative)	***What are the observed and potential impacts of climate change in our community?*** A quantitative vulnerability assessment can be used to describe specific risks to key assets from climate change. Assessing vulnerability involves identifying the degree of exposure and sensitivity of people, natural resources, and the built environment to climate hazards and the capacity of the these resources to adapt climate change.	LEAP Guide – Steps Three and Four A Framework for Social Adaptation to Climate Change: Sustaining Tropical Coastal Communities and Industries (Marshall et al., 2010)

Level 2 – Laying a Solid Foundation		
Benchmarks for Local Implementation	**Description**	**Selected Guides and Tools**
		Philippine Vulnerability Assessment Tools for Coastal Ecosystems (MERF and CI, 2013) Incorporating Climate and Ocean Change into an Ecosystem Approach to Fisheries Management (EAFM) Plan (Heenan et al., 2013)
☐ Early actions and timeline for implementation reviewed and updated	*What early actions should be taken to reduce vulnerability?* Early actions should be reviewed and updated to respond to climate changes and vulnerability. Early actions may include reducing exposure (e.g., establishing coastal setbacks for new development); reducing sensitivity (e.g., reducing non-climate stressors such as overfishing and pollution); and increasing adaptive capacity (e.g., establishing early warning systems for disaster management). Emphasis should be placed on integrating early actions into existing policies, plans, and programs rather than creating new ones (laws to better manage shoreline development, permit systems, coastal zone management plans, etc.).	LEAP Guide – Step 4
☐ Local early adaptation actions results incorporated into plans and programs	*Why should local early adaptation actions be incorporated into plans and programs?* Early adaptation actions will cover a range of sectors from public services, economic development, and natural resource management. These should be incorporated into existing plans and programs to ensure that funding and implementation mechanisms are available.	LEAP Guide –Step 4 and Appendix B
☐ At least four early adaptation actions implemented with success	*What adaptation actions should we initiate?* Adaptation actions are designed to address the dual goals of sustainable development and risk reduction. This means balancing social, economic, and environmental objectives and reducing risk from climate change and other hazards. Resilience-building best practices meet these objectives through design and implementation.	LEAP Guide –Step 4 and Appendix B Locally-Managed Marine Areas: A Guide to Supporting Community-based Adaptive Management (Govan et al., 2008)

Level 2 – Laying a Solid Foundation		
Benchmarks for Local Implementation	**Description**	**Selected Guides and Tools**
		How Resilient Is Your Coastal Community? A Guide for Evaluating Coastal Community Resilience to Tsunamis and Other Hazards (U.S. Indian Ocean Tsunami Warning System Program, 2007)
☐ Monitoring of climate impacts and effectiveness of adaptation strategies conducted	*What monitoring should be conducted to evaluate the effectiveness of adaptation actions over time?* Changing climate conditions means the impacts and adaptation actions to address these impacts need to be monitored and evaluated for effectiveness. Evaluation is the process of reviewing and analyzing all relevant data and information required to determine if the set of adaptation actions is performing to expectation. The goal of evaluation is to assess the performance of adaptation actions in terms of their design and implementation.	LEAP Guide – Steps 2, 3, 4, and Appendix C Participatory Monitoring, Evaluation, Reflection and Learning for Community-based Adaptation: A Manual for Local Practitioners (Ayers et al., 2012) Making Adaptation Count: Concepts and Options for Monitoring and Evaluation of Climate Change Adaptation (Spearman and McGray, 2011) Desk Review: Evaluation of Adaptation to Climate Change from a Development Perspective (Hedger et al., 2008) SEM-Pacifika: Socioeconomic Monitoring Guidelines for Coastal Managers in Pacific Island Countries (Wongbusarakum et al., 2008) Indicators to Assess Community-level Social Vulnerability to Climate Change: An Addendum to SocMon and SEM-Pasifika Regional Socioeconomic Monitoring Guidelines (Wongbusarakum and Loper, 2011)

Checklist for Level 3: Responding to Changing Adaptation

Level 3 – Responding to Changing Conditions Objective: Climate adaptation mainstreamed into policies, plans, programs, and decision-making processes across all sectors with monitoring, results, and positive returns.		
Benchmarks for Local Implementation	**Description**	**Selected Guides and Tools**
☐ National, regional, and international partnerships established to support long-term adaptation	*What types of partnerships should be explored?* Local adaptation efforts need to be integrated or linked with other subnational, national, regional, or international programs to scale up adaptation to address medium- and long-term priorities. Partners may include those from government agencies, the private sector, and funding organizations.	Public-Private-Partnership Handbook (Asian Development Bank, 2008)
☐ CCA mainstreamed into policies, plans, and programs	*What does "mainstreaming" climate adaptation mean?* Mainstreaming is the integration of climate change risk assessments and adaptation actions into all plans, policies, and programs as a regular course of business. This means infrastructure, utilities, coastal development plans, agriculture, health, education, natural resource, and environmental plans, policies, and programs integrate climate change risks and adaptation actions.	Adapting to Coastal Climate Change: A Guidebook for Development Planners (Coastal Resources Center at the University of Rhode Island, 2009)
☐ At least 6 early adaptation actions implemented with d success	*What adaptation actions should we initiate?* Adaptation actions are designed to address the dual goals of sustainable development and risk reduction. This means balancing social, economic, and environmental objectives and reducing risk from climate change and other hazards. Adaptation actions should meet these objectives through design and implementation.	LEAP Guide – Step 4 and Appendix B
☐ Monitoring of climate impacts and effectiveness of adaptation strategies conducted to adapt and improve management	*What monitoring should be conducted to evaluate the effectiveness of adaptation actions over time?* Changing climate conditions means the impacts and adaptation s to address these impacts need to be monitored and evaluated for effectiveness. Evaluation is the process of reviewing and analyzing all relevant data and information required to determine if the set of adaptation s is performing to expectation. The goal of evaluation is to assess the performance of adaptation s in terms of their design and implementation.	LEAP Guide – Step 2, 3, 4, and Appendix C Participatory Monitoring, Evaluation, Reflection and Learning for Community-based Adaptation: A Manual for Local Practitioners (Ayers et al., 2012)

Level 3 – Responding to Changing Conditions		
Benchmarks for Local Implementation	**Description**	**Selected Guides and Tools**
		Making Adaptation Count Concepts and Options for Monitoring and Evaluation of Climate Change Adaptation (Spearman and McGray, 2011) Desk Review: Evaluation of Adaptation to Climate Change from a Development Perspective (Hedger et al., 2008) SEM-Pacifika: Socio-economic Monitoring Guidelines for Coastal Managers in Pacific Island Countries (Wongbusarakum et al., 2008) Indictors to Assess Community-level Social Vulnerability to Climate Change: An Addendum to SocMon and SEM-Pasifika Regional Socioeconomic Monitoring Guidelines (Wongbusarakum and Loper, 2011)

Appendix D
LEAP Process Worksheets

Worksheet 1-1: CCA Team Members to Support Planning

Existing Policies, Plans, Programs, Projects in the Community	Opportunities for Integrating Climate Adaptation	Potential Team Members and Role
Community Development (population centers, health care, hospitals, schools, transportation, drinking water wells, roads, ports, tourism, aquaculture, agriculture, fishing infrastructure)		
Natural Resource Management (water quality and quantity; coastal and fisheries resources including habitats such as rivers, wetlands, estuaries, mangroves, seagrass, coral reefs)		
Disaster Management (hazard detection, early warning, disaster mitigation, disaster response, and recovery)		

Worksheet 1-2: Community Background Information

Question	Answer
Where is your community located?	
About how many people live in your community?	
What are the major occupations (income-generating and subsistence activities) of community members?	
What are the main stakeholder groups in your community?	
How are decisions made in your community? Who has authority?	
What social groups are currently active and what purpose do they serve?	
What are the main strengths of your community?	
What aspects of natural resource management are in place and working well?	
What aspects of social infrastructure (schools, roads, health care, etc.) are in place and working well?	
Please explain 1 to 3 priority natural resource threats or problems your community is facing. Provide details.	
Please explain 1 to 3 priority social threats or problems your community is facing. Provide details.	
What community initiatives are underway or planned (e.g., drinking water, sanitation, transportation, housing, fisheries, agriculture, forestry)?	
What are the priority development objectives of the community (e.g., improve drinking water, diversify livelihoods, improve fish catch)?	

Worksheet 1-3: Getting Organized Checklist

Question	Answer
☐ A CCA planning team has been identified that is capable of and committed to facilitating the planning process.	*List team members:*
☐ Priority development objectives of the community have been identified.	*List objectives:*
☐ Geographic boundaries of the planning area have been defined.	*Describe the area's boundaries:*
☐ Opportunities to integrate climate adaptation into existing policies, plans, programs, and projects that support priority development objectives in the community have been identified.	*The existing plan(s) are:*
☐ Leaders in the community understand the reasons for adaptation and want to plan for it.	*Explain why community leaders want to do a LEAP:*
☐ Local leaders, experts, and partners covering multiple sectors have been identified to support planning efforts.	*List additional team members and their roles in awareness-raising and/or planning:*
☐ Key stakeholder groups have been identified and understand how they will be engaged in the planning process.	*List stakeholder groups:*
☐ Community is ready to engage in the planning process.	*Please explain:*
☐ Individuals/agencies with the authority to make management decisions for the area and to adopt the final plan have been engaged.	*Please explain:*
☐ Existing information about the area (e.g., community initiatives, maps, historical photos, social or biological studies, information on climate) has been compiled.	*Information includes:*
☐ A target date for finishing the planning process has been established.	*Target date for completion of the LEAP:*
☐ Sufficient time and financial resources to complete the planning process have been committed by the team.	*List financial sources and agreed-upon time allowance:*

Worksheet 2-1: Seasonal Calendar

Seasonal Calendar: Normal year in top row; seasonal changes in recent years in bottom row.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Normal Year												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Observed Changes												

Summary of seasonal changes in recent years, along with ecological and social changes:

Worksheet 2-2: Indicators of a Changing Climate

Climate Threat			Impacts
Indicator	Magnitude and direction of change over time based on community knowledge and latest climate science	Changes in environmental conditions	Potential impacts to ecological and social resources
Air temperature			
Sea-surface temperature			
Sea level			
Rainfall patterns			
Ocean pH			
Ocean circulation			
Tropical cyclones			

Worksheet 2-3: Ecological and Social Target Resources

ECOLOGICAL AND SOCIAL TARGET RESOURCES				
Priority Target Resources	**Resource Dependency**	**Resource Condition**	**Resource Linkages**	**Potential Climate Impacts to Target Resources**
List ecological and social targets	*What is the importance of this resource to the community (high, medium, or low), and why?*	*What is the condition of this resource, and is it getting better, worse, or staying the same?*	*How does the condition of this resource affect other ecological and social target resources?*	*What are the potential impacts of climate change to target resources?*
Ecological Targets				
1.				
2.				
3.				
4.				
5.				
Social Targets				
6.				
7.				
8.				
9.				
10.				

Worksheet 2-4: Summary of Past, Present, and Future Climate Change

Summary of Past, Present, and Future Climate Change
OBSERVATIONS OF PAST AND PRESENT IMPACTS: Based on historical trends, what climate events are most frequent, and which have the greatest impacts? What changes to the normal seasons is the community noticing, and what are the impacts of those changes that most concern the community? Where are these changes or hazards occurring? (Use Historical Timeline and Community Map.)
FUTURE: Based on the community's past experience and the current situation, which of the projected climate threats and impacts most concern the community, and why? (Use available scientific projections, indicators of a changing climate, and observations from past and present.)

Worksheet 2-5: Climate Story Template

COMMUNITY NAME:
[INSERT PICTURE OF COMMUNITY MAP]

INDICATORS OF A CHANGING CLIMATE			
	Climate Threat		Impacts
Indicator	Magnitude and direction of change over time based on community knowledge and latest climate science	Changes in environmental conditions	Potential impacts to ecological and social resources
Air temperature			
Sea-surface temperature			
Sea level			
Rainfall patterns			
Ocean pH			
Ocean circulation			
Tropical cyclones			

OBSERVATIONS OF PAST AND PRESENT IMPACTS: **Based on historical trends, what climate events are most frequent, and which have the greatest impacts? What changes to the normal seasons is the community noticing, and what are the impacts of those changes that most concern the community? Where are these changes or hazards occurring?** (Use Historical Timeline, Seasonal Calendar, and Community Map.)

[Insert pictures of Historical Timeline and Seasonal Calendar.]

FUTURE: Based on the community's past experience and the current situation, which of the projected climate threats and impacts most concern to the community, and why? (Use available scientific projections, the indicators of a changing climate, and observations from the past and present.)

[Insert other pictures and information the community deems important.]

Worksheet 3-1: Target Resource Conditions and Trends

TARGET RESOURCE CONDITIONS AND TRENDS	
TARGET RESOURCE: Consider social (people, health, social networks); economic (property, infrastructure, income); and ecological (natural resources and ecological services) targets. **Current Conditions:** Describe the current conditions of the target resource. **Trend:** Describe the trend of the target resource.	**Condition and Trend Rating**
List Non-Climate Threats and Root Causes	
SUMMARY	

Worksheet 3-2: Exposure of Target Resource to Climate Threats

EXPOSURE	
TARGET RESOURCE: Which climate threats have come into contact with this resource or will in the future, based on climate projections? Are these threats increasing or decreasing? In the future, will this resource come into contact with these threats rarely, sometimes, or frequently? Specify which threats.	
Rate the exposure of the target resource to climate threats as **low, medium, or high.**	RATING
SUMMARY	

Worksheet 3-3: Sensitivity of Target Resource to Climate Threats

SENSITIVITY	
TARGET RESOURCE: What is the current condition of the target resource? What man-made (non-climate) threats are impacting the target resource? How severe are those threats? How severely was this target resource impacted by past climate events? How will future climate threats affect the condition of the target resource?	
Rate the sensitivity of the target resource to the climate threats as **low, medium, or high.**	RATING
SUMMARY	

Worksheet 3-4: Potential Impact Rating

POTENTIAL IMPACT (Exposure + Sensitivity)	
TARGET RESOURCE:	
Rate the potential impact to the target resource based on the exposure and sensitivity as **low, medium, or high.**	RATING
SUMMARY	

Worksheet 3-5: Adaptive Capacity to Climate Impacts

ADAPTIVE CAPACITY	
TARGET RESOURCE: What is the adaptive capacity of the natural environment to withstand climate impacts? Have you observed recovery or resilience to past hazards in this resource? Explain. What actions have been/are being taken to prepare for or cope with potential impacts to this resource? Are there existing systems in place that could reduce potential impacts of climate change? What is the adaptive capacity of the community to withstand climate impacts? How has the community been able to withstand other types of hazards or challenges? What is the adaptive capacity of institutions to support climate adaptation? Are national or local governments and organizations supporting planned adaptation?	
Rate the adaptive capacity of the target resource and the community to climate impacts as **low, medium, or high.**	RATING
SUMMARY	

Worksheet 3-6: Vulnerability Rating

VULNERABILITY (Potential Impact + Adaptive Capacity)	
TARGET RESOURCE:	
Rate the vulnerability of target resource based on the potential impact and the adaptive capacity as **low, medium, or high.**	RATING
SUMMARY VULNERABILITY STATEMENT	

Worksheet 3-7: Vulnerability Assessment Matrix

TARGET RESOURCE: CONDITION AND TRENDS:					Condition and Trend Rating
CLIMATE THREATS	EXPOSURE	SENSITIVITY	POTENTIAL IMPACT (Exposure + Sensitivity)	ADAPTIVE CAPACITY	VULNERABILITY (Potential Impact + Adaptive Capacity)
	Exposure Rating	Sensitivity Rating	Potential Impact Rating	Adaptive Capacity Rating	Vulnerability Rating
	VULNERABILITY STATEMENT: Condition and Trends: Vulnerability: Resource Dependency:				

Worksheet 3-8: Vulnerability Assessment Summary

TARGET RESOURCE	VULNERABILITY STATEMENT	CONDITION AND TRENDS RATING	VULNERABILITY RATING

Worksheet 4-1: Adaptation Options

ADAPTATION OPTIONS						
Target Resource: Vulnerability Statement:						
	FACTORS TO CONSIDER IN PRIORITIZING ADAPTATION OPTIONS					
Adaptation Options	Effectiveness		Cost/Benefit		Feasibility	
	To what extent does the action address non-climate threats and root causes?	To what extent does the action reduce vulnerability? (↓Exposure, ↓Sensitivity, ↑Adaptive Capacity)	To what extent does the action achieve multiple (social, ecological, and economic) benefits?	Are there any potential negative, unintended consequences of the action?	To what extent is the action feasible?	What is the capacity to implement the action?

Worksheet 4-2: Priority Adaptation Actions and Implementation Schedule

Priority Adaptation Actions and Implementation Schedule				
Target Resource	Priority Adaptation Action	Timeframe	Lead and Partners	Resources or Support Needed

Worksheet 4-3: Local Early Action Plan Outline

1. **Community Background** (Output of Step One)
   Summary Description (location, population size and characteristics, social and ecological resources and threats)

2. **Climate Story** (Output of Step Two)
   Community Map
   Historical Timeline
   Seasonal Calendar
   Indicators of a Changing Climate
   Target Resources and Status

3. **Vulnerability Assessment** (Output of Step Three)
   Vulnerability Assessment Summary for All Target Resources

4. **Priority Adaptation Actions and Implementation Schedule** (Output of Step Four)

Priority Adaptation Actions and Implementation Schedule				
Target Resource	Priority Action	Timeframe	Lead and Partners	Resources or Support Needed

5. **Monitoring and Evaluation Approach** (Output of Step Four)
   Indicators (baseline data, monitoring approach)

Appendices:
- Vulnerability Assessment Matrix by Target Resource (Target-specific outputs from Step Three)
- Adaptation Options Matrix by Target Resource (Target-specific outputs from Step Four)

Helping communities understand climate change and its effects on their lives and livelihoods is a critical first step in taking local early action to address climate impacts.

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WWF
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