REVISED, DECEMBER 2013

PACC

Building Resilience to Climate Change in Pacific Communities

MAINSTREAMING CLIMATE CHANGE INTO DEVELOPMENT IN THE PACIFIC

A PRACTICAL GUIDE

SPREP
Secretariat of the Pacific Regional Environment Programme

UNDP

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Australian Aid

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ABBREVIATIONS

ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
AusAID	Australian International Aid Agency
BOM	Bureau of Meteorology (Australia)
CBA	Cost–benefit analysis
CBD	Convention on Biological Diversity
CV&A	Community-based vulnerability and adaptation assessment
CCA	Climate change adaptation
CCPIR	Coping with Climate Change in the Pacific Islands Region
CePaCT	Centre for Pacific Crops and Trees
CIE	Department of Commerce, Industry and Environment (Nauru)
CLIMAP	Climate Change Adaptation Project for the Pacific (ADB)
CM	Common Methodology (IPCC)
CRM	Climate risk management
CROP	Council of Regional Organisations in the Pacific
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
DCCEE	Department of Climate Change and Energy Efficiency (Australia)
DM	Disaster management
DPSIR	Driver-pressure-state-impact-response [framework]
DRR	Disaster risk reduction
DRR&DM	Disaster risk reduction and disaster management
EbA	Ecosystem-based adaptation
EIA	Environmental impact assessment
ENSO	El Niño Southern Oscillation
ERA	Environmental risk assessment
FSM	Federated States of Micronesia
GCM	Global climate models
GDP	Gross domestic product
GEF	Global Environment Facility
GEF-SCCF	Global Environment Facility–Special Climate Change Fund
GIS	Geographic information system
GIZ	Gesellschaft für Internationale Zusammenarbeit
HFA	Hyogo Framework of Action
HH	Household
IPCC	Intergovernmental Panel for Climate Change
IWRM	Integrated Water Resources Management
JNAP	Joint National Action Plan for Climate Change and Disaster Risk Management
M&E	Monitoring and evaluation
MCA	Multi-criteria analysis

MDGs	Millennium Development Goals
NAP	National Action Plan
NAPA	National Adaptation Plan of Action
NIWA	National Institute of Water and Atmospheric Research (New Zealand)
NSDS	National Sustainable Development Strategy
NZAID	New Zealand Aid Programme
OECD	Organisation for Economic Cooperation and Development
PAA	Prioritised Action Agenda (Vanuatu)
PACC	Pacific Adaptation to Climate Change
PCCSP	Pacific Climate Change Science Program
PICTs	Pacific island countries and territories
PIFACC	Pacific Islands Framework of Action on Climate Change
PPAC	Pacific Plan Advisory Committee
PWD	Public Works Department (Vanuatu)
RFA	Regional Framework of Action (Pacific Framework of Action on Disaster Risk Reduction and Disaster Management)
SEA	Strategic environmental assessment
SIRIP	Solomon Islands Road Improvement Project
SLA	Sustainable livelihood assessment/analysis/approach
SOPAC	Applied Geoscience and Technology Division of the Secretariat of the Pacific Community
SPC	Secretariat of the Pacific Community
SPREP	Secretariat of the Pacific Regional Environment Programme
TLB	Taro leaf blight
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USP	University of the South Pacific
V&A	Vulnerability and adaptation assessment
WHO	World Health Organization
WST	[Western] Samoa Tala

FOREWORD

Climate change risks that impact development in the Pacific region will be with us for a long time. Social, economic, political and environmental development goals will not be achieved or sustained in the region if climate change risks are not given consideration at all phases of the development process. This guide provides a practical tool for planners and practitioners at the national level, as well as supporting the climate change mainstreaming efforts of regional organisations and partners.

The Pacific Adaptation to Climate Change (PACC) project, implemented by the Secretariat of the Pacific Regional Environment Programme (SPREP), has put together this guide as a response to the need from PACC-participating countries to integrate climate change risks into their national and sector strategies and plans, and budgetary processes. The relevance of this guide will not only be limited to PACC, but will be applicable to other climate change and risk management projects that are currently being implemented in the region or are currently at the development phase.

SPREP gratefully acknowledges the funding from the Global Environment Facility (GEF) and technical guidance from the United Nations Development Programme (UNDP), provided through the PACC project, which made the development of this guide possible. Up-scaling and replication of some national PACC activities has already commenced in some countries using added financial resources from the Australian Government. We look forward to further support in this area, and for other mainstreaming efforts in the region.

The support of regional organisations and partners in the development of this guide, such as the Secretariat of the Pacific Community (SPC), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), and the Pacific Regional and Samoa National Offices of UNDP, are also gratefully acknowledged, as is the work of the consultant, Dr Padma Lal.

In time, this guide will be reviewed and updated as Pacific island counties and territories (PICTs) gain more experience and access more climate change information. This guide is a first step, and it is based on Pacific experiences to advance climate change mainstreaming efforts.

I would like to commend initiatives that support climate change mainstreaming efforts, both at the regional and national levels, and call for its continuation in order to reach every sector, every level, every woman and man, young and old, in the region.

DAVID SHEPPARD
Director General
SPREP

ABOUT THE GUIDE

Managing the effects of weather and climate is not a new activity in the Pacific. Pacific island countries and territories (PICTs), their people and communities, have always responded in many different ways to climate-related challenges such as droughts, floods, cyclones and storm surges. More recently, the focus has shifted to reducing the risks related to weather and climatic variability and climate extremes, including those resulting from climate change due to global warming. At the regional level, responses to these risks have been guided by the Pacific Islands Framework for Action on Climate Change (PIFACC) and the Pacific Regional Framework for Action on Disaster Risk Reduction and Disaster Management (referred to in this guide as the Regional Framework for Action or RFA); and their respective international instruments, the United Nations Framework Convention on Climate Change (UNFCCC) and the Hyogo Framework for Action (HFA).

PICTs have implemented a wide spectrum of initiatives and activities across national and subnational levels, targeting specific communities and sectors. These have focused on producing policies, plans and strategies as well as the on-the-ground initiatives aimed at reducing and managing disaster risks, including climate-compatible developments and ecosystem-based adaptation (EbA) measures. The Pacific Adaptation to Climate Change (PACC) programme is an example of such an initiative. The PACC programme is funded under the Global Environment Facility's Special Climate Change Fund (GEF-SCCF) and implemented by UNDP in partnership with SPREP across 14 countries. Mainstreaming climate change into national and sector levels of policies and plans is one of the key objectives of the PACC programme, together with on-the-ground demonstration activities in each of the participating countries.

Recent reviews of disaster risk management and climate change adaptation projects in the Pacific, and discussions with disaster risk and climate change officers in various PICTs, have highlighted some challenges and gaps in knowledge relating to climate change and its mainstreaming into development planning and activities. People often ask questions such as:

- What does mainstreaming mean?
- Where in the development process should mainstreaming be applied?
- How can climate risk considerations be integrated in the development process?
- How can relevant climate change adaptation measures be identified?
- What information and knowledge is required to support a mainstreaming exercise?
- What institutional and human capacity may be required?
- Who needs to be involved in a mainstreaming exercise and what role should they play?
- What tools are available to support mainstreaming?

This guide aims to help answer these questions. It provides a practical step-by-step approach to mainstreaming climate risk considerations into the development processes used in PICTs. The guide covers mainstreaming at two broad levels: the strategic or policy level, and on-the ground initiatives or project level. The approach follows standard policy and project cycles, and combines elements from climate risk management. Many examples and case studies from the region are included, to illustrate mainstreaming as it is happening in practice.

This guide is targeted at in-country practitioners, staff in regional governments and organisations, and development partners, to assist and support their efforts to integrate climate risk into development planning and decision-making processes. Efforts to mainstream climate change into national development are at a relatively early stage in most PICTs, but in time there will be more experience, new information and new lessons learned. It is hoped that these can be shared and used to revise and update this guide in the next few years.

Structure

This guide is divided into three parts. Part 1 provides an overview of climate change mainstreaming, including the concepts and principles behind the recommended approach, and outlines the approach. Part 2 offers a guide to mainstreaming at the strategic level, describing activities, tools and outputs corresponding to the seven phases of the policy cycle-based process, and includes examples from the mainstreaming activities supported by PACC and other initiatives in the Pacific. Part 3 provides an on-the-ground mainstreaming guide, and includes detail on project-level activities, tools and outputs. Five case studies provide detailed examples of climate change mainstreaming at the project level in the region.

PART 1

BACKGROUND

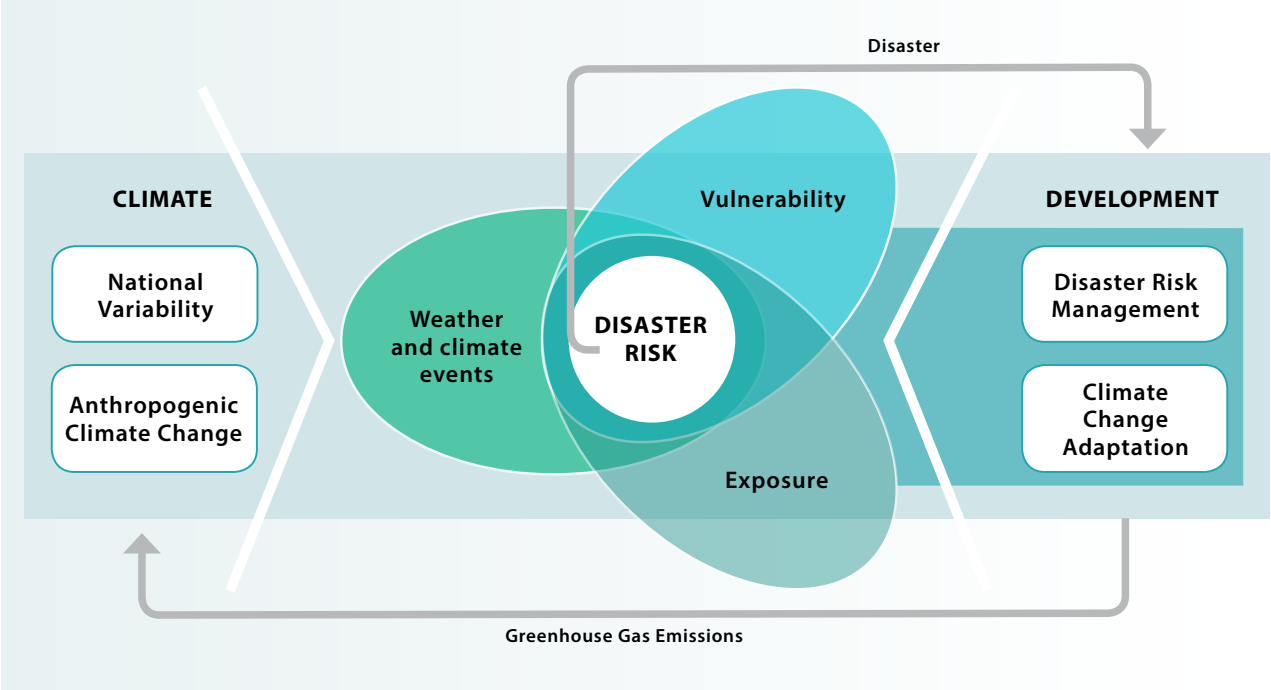
PART 1. BACKGROUND

1.1. Mainstreaming: definitions, concepts and principles

The multifaceted nature of climate change and its impacts on people, society, environment and economy means it needs to be tackled within the development context. Climate change mainstreaming is a way of doing this. Climate change mainstreaming is about integrating climate risks into development planning and decision-making processes. This means incorporating climate risk considerations into every aspect of the policy and project development process and decisions by government, communities and private sector.

Climate risk is defined as the expected losses resulting from the interaction of weather-related hazards, exposure and vulnerability (IPCC, 2012). This is illustrated in Figure 1.1 (with climate risk depicted as disaster risk). The key concepts are explained in Box 1.1.

FIGURE 1.1. Disaster risk results from the interaction between weather-related hazards, exposure and vulnerability of social, economic and environmental systems. (Source: IPCC (2012).)



Mainstreaming is in effect about simultaneously considering weather and climate risks along with other drivers of risk and development interests. It is relevant to decisions made by all government agencies and across all sectors (e.g. finance, planning, health, agriculture, and environment), and at all levels of government (national and subnational), as well as by communities and private sector. When climate risks are explicitly considered, the policy or project will not only be more effective at meeting its original development objectives, but also should not inadvertently create or increase vulnerability to climate change, and indeed should reduce vulnerability. Climate change mainstreaming will contribute to more sustainable development and more resilient communities.

For some policies and projects, climate risk will be a major consideration and will require substantive analytical inputs. For others, climate risk may be a very minor consideration and would warrant only a small amount of additional analytical work and changes. Mainstreaming climate risk is a process rather than a goal, and the outputs of the mainstreaming exercise are the actual development outcomes. Over time, when climate risk consideration becomes an integral part of the development process, climate change mainstreaming will no longer need to be emphasised as a separate issue.

BOX 1.1. SOME KEY CONCEPTS RELATING TO CLIMATE RISK

CLIMATE CHANGE

Climate change is commonly referred to as long-term changes in weather and climate conditions, i.e. changes in the mean and/or the variability of a climate property such as precipitation, temperature or wind force, and that persists for an extended period, typically a decade or longer. It also includes changes in sea level rise due to increased global warming. With climate change, disaster risks change in terms of scale, scope, frequency and intensity.

NATURAL HAZARDS

A hazard is a potentially damaging physical event, phenomenon or human activity which may cause loss of life or injury, property damage, social and economic disruption or environmental degradation (ISDR, 2004). Natural hazards include drought, cyclones, and extreme rainfall events. Under the effects of climate change, the frequency and intensity of natural hazard events is changing, however the direction and magnitude of these changes are not well understood. Accounting for this uncertainty is a key part of climate change adaptation policy development, and for mainstreaming climate risks generally.

EXPOSURE

Exposure refers to the inventory of elements – human lives, livelihoods, and economic or environmental assets – that are in an area in which hazard events may occur.

VULNERABILITY

Vulnerability refers to the sensitivity of exposed elements to damage and loss from a hazard event in that area. It also refers to the ability or capacity of affected parties to respond to extreme events and to cope with the immediate effects and rebuild. Vulnerability to natural disasters, development and environment are inextricably linked (ISDR, 2004). For example, vulnerability is high in areas with poor infrastructure, which affects people's ability to engage in income-generating activities and reduces their ability to respond to disasters. Poor infrastructure standards, weak government regulations (such as the absence of building codes) and weak regulatory enforcement also increase disaster risks. Pacific island countries rely heavily on the primary sector and are generally very sensitive to the effects of natural disasters, particularly disasters of hydro-meteorological origin.

RESILIENCE

Resilience can be defined as the ability of a system (human or environmental) to resist, absorb and recover from the effects of hazards in a timely and efficient manner, preserving or restoring its essential basic structures, functions and identity (CARE International, 2010). A resilient community is well-placed to manage hazards, to quickly respond to and recover from any negative impacts, resulting in a similar or improved state as compared to before the hazard occurred. There are strong linkages between resilience and adaptive capacity. It should also be noted that resilience can vary for different groups within a community.

There are several key principles which underpin the approach advocated in this climate risk mainstreaming guide. These principles are summarised in Box 1.2, as they apply at the strategic level. The same principles are also relevant at other levels of mainstreaming, adapted as necessary.

BOX 1.2. PRINCIPLES UNDERPINNING EFFECTIVE MAINSTREAMING

PRINCIPLE 1 – TAKE A 'WHOLE-COUNTRY' APPROACH.

An effective national system for climate risk management requires multiple actors: government and non-government, community-based organisations, private sector and research bodies, playing different but complementary roles.

PRINCIPLE 2 – TAKE A 'WHOLE-GOVERNMENT' APPROACH.

An integrated 'whole-of-government' approach, preferably coordinated at the highest level of government, is required to address the multifaceted challenges of climate change adaptation within the development context, and the multisectoral and multiagency responses required to address current and projected weather and climate risks.

PRINCIPLE 3 – BUILD ON EXISTING DEVELOPMENT GOVERNANCE.

An appropriate interagency governance arrangement, including organisational arrangements and decision-making processes used to formulate policies, plans and programmes of work, will increase the effectiveness of integrated development and climate-related actions.

PRINCIPLE 4 – ENSURE ACTIVE STAKEHOLDER ENGAGEMENT.

Local stakeholder engagement, as well as a clearly identified lead agency and roles of in-country government agencies (and CROP agencies), will encourage cost-effective identification of locally relevant and owned risk reduction and resilience building measures.

PRINCIPLE 5 – ADDRESS CURRENT DISASTER RISKS AND ADOPT A SPECTRUM OF ADAPTATION MEASURES.

Addressing sources and drivers of current disaster risk is a good starting point for adapting to projected climate change. The spectrum of measures should include climate-compatible development, no-regrets measures that provide economic and social benefits and environmental conservation benefits today, and which also lay the foundation to reduce future hazards and exposures, as well as measures that improve current disaster management.

PRINCIPLE 6 – PRIORITISE COLLECTION OF BASELINE DATA AND INFORMATION.

Robust country-specific information is required to support vulnerability, risk and risk reduction assessments and the identification of appropriate adaption measures.

PRINCIPLE 7 – INTERDISCIPLINARY CAPACITY IS VITAL.

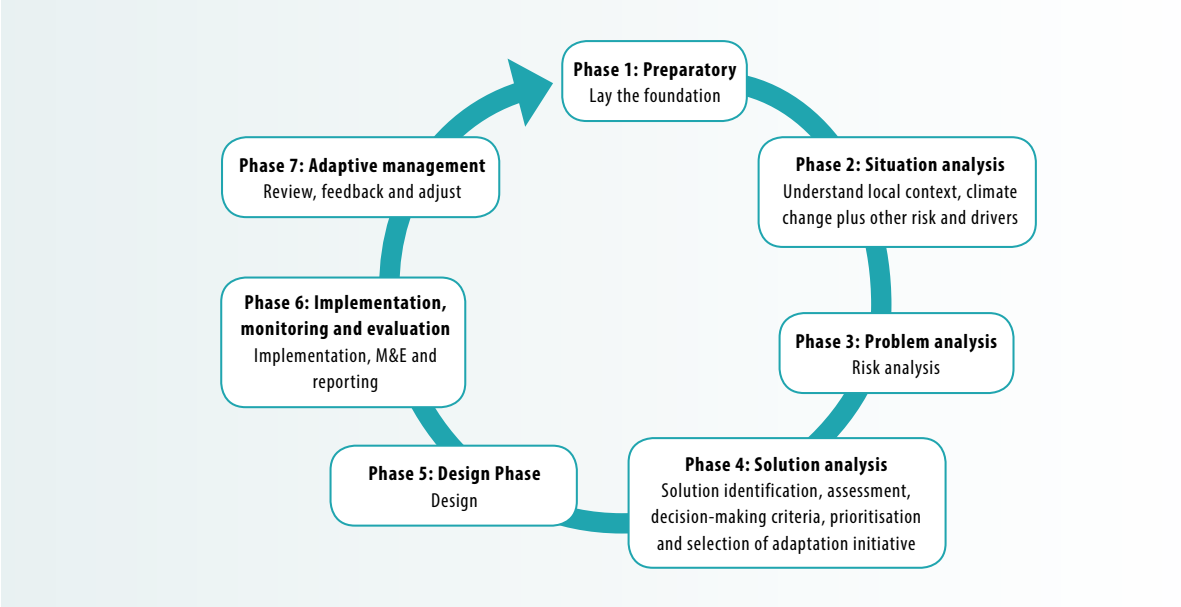
Strong interdisciplinary technical capacity, either accessed from within the country or externally, is required to support the mainstreaming process, as well as to inform key decisions by governments and communities during the policy/project cycle-based development processes integrating climate risk considerations.

1.2. An approach to climate change mainstreaming

The approach to climate change mainstreaming set out in this guide combines the normal decision-making processes of a policy or project cycle and technical assessments based on the climate risk management (CRM) framework, drawing on Mechler (2005), OECD (2009) and Olhoff and Schear (2010).

The standard decision-making process follows a set of steps including (1) preparatory, (2) situation analysis, (3) problem analysis, (4) solution analysis (identification and selection of options), (5) design, (6) implementation, monitoring and evaluation, and (7) review (Figure 1.2). These are the broad steps that governments and others normally work through when developing and implementing evidence-based interventions or informed decisions, where the earlier step informs the next. This cycle can be applied when developing high-level strategies, plans and policies as well as on-the-ground initiatives and measures.

FIGURE 1.2. The standard seven-phase policy/project decision-making cycle.

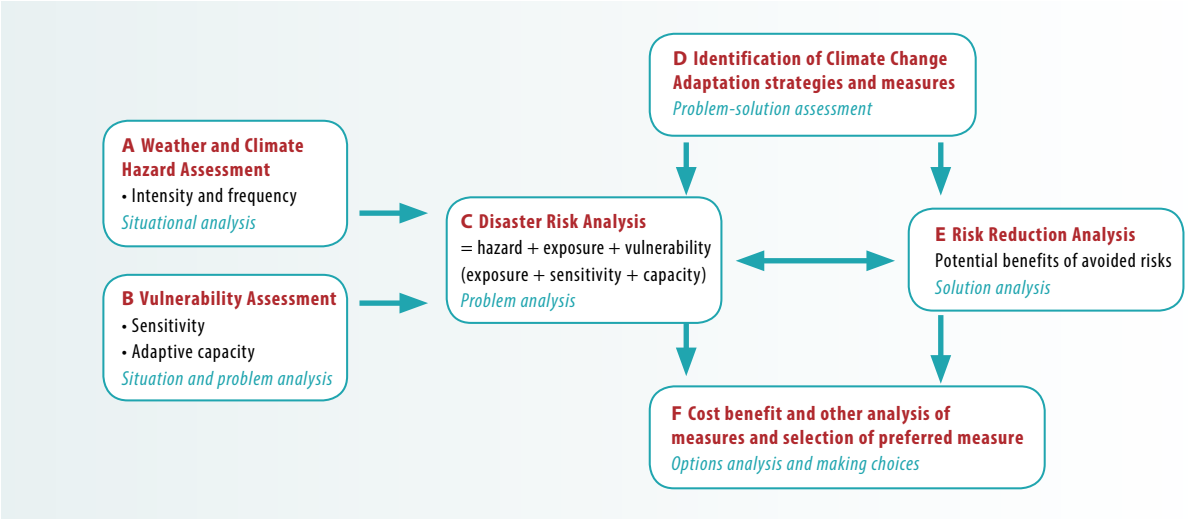


The specific activities, tools, and outputs for each of these steps depends on the nature of the problem, and analysis required which may need specialised scientific and technical inputs. It also depends on the level of the intervention (i.e. strategic versus on-the-ground initiative).

CRM is a systematic framework for undertaking technical analysis to support risk-based decisions. CRM is similar to the disaster risk management (DRM) framework which is used in all-hazards disaster risk reduction (DRR) across the Pacific region; CRM and DRM are becoming less differentiated when it comes to weather- and climate-related events. As the basis of CRM, historical weather and climate information are used to estimate the likelihood and severity of expected hydro-meteorological hazards. These, together with impact analysis of past disaster events, are used to predict potential impacts under future climate scenarios.

The key technical steps of CRM are summarised in Figure 1.3. These are (A) hazard assessment, (B) vulnerability assessment, (C) risk assessment, (D) identification of possible risk reduction or adaptation strategies and measures, and (E) analysis of measures. To support CRM, standard cost–benefit analysis and other assessments (for example multi-criteria analysis) are also carried out to identify economically viable and feasible measures, and selection of the preferred measure (F).

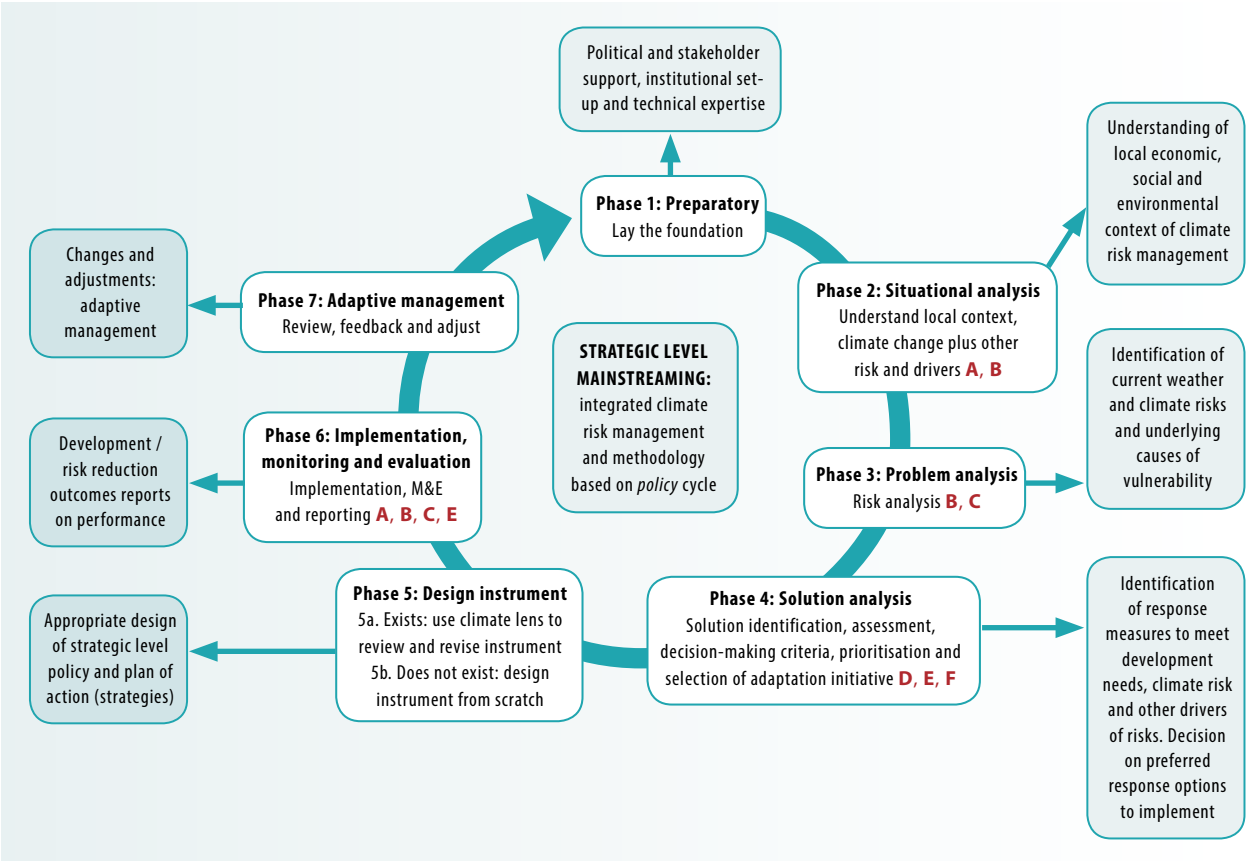
FIGURE 1.3. The key technical steps in climate risk management **in red**, with corresponding policy/ project cycle steps in blue italics. (Adapted from Mechler (2005).)



The policy cycle phases, corresponding CRM-based steps, and key decisions and outputs from the different phases are shown in Figure 1.4. The analytical inputs from CRM are shown as red letters (A to F) within the relevant policy cycle phase. The key decisions and outputs at each phase of the mainstreaming process are described in the outer boxes.

The mainstreaming exercise thus involves integrating climate risk considerations into the policy or project decision-making cycle. This involves incorporation of technical analysis of risks, and identification of risk reduction and risk management options.

FIGURE 1.4. Strategic level climate risk mainstreaming methodology based on a combined CRM and policy cycle: key phases, and respective decisions and outputs.



Mainstreaming of climate risks is relevant across all levels of development decisions. There are multiple entry points for mainstreaming climate risk into development processes. For example, it can be done when developing or revising national sustainable development plans, sectoral policy and plans, or when developing community-based strategic plans. It can also be 'added-on' to an existing strategic instrument, i.e. an existing policy or plan can be retrospectively 'climate-proofed'. Regardless of entry point, mainstreaming is essentially about integration of climate risks into development. In all situations of mainstreaming, the seven-phase process can be applied to help systematically include climate risk considerations in the planning process.

On-the-ground level mainstreaming, too, can be guided by the use of the standard decision-making process. The project cycle has a similar set of steps, that is, situation analysis, problem analysis, identification of adaptation options, selection, implementation, evaluation and feedback. Project-level mainstreaming is about integrating climate risk considerations into on-the-ground economic, social and environmental development projects, as well as identifying and implementing climate-oriented initiatives to reduce specific risks, manage residual risk, and/or build resilience of targeted communities.

The key differences between mainstreaming at the strategic level and on-the-ground are geographic and temporal scale and scope, level (vertically) of decision-making, and the level of context-specific information required. The nature of the outputs from each of the phases is also different, reflecting context-specific assessments.

Strategic level responses to climate change by governments create the enabling environment (policies, plans and legislations) for government agencies to engage with climate risk reduction and risk management, and for private sector and communities to take their own steps to reduce their risks and manage residual risks. These strategic instruments are also used by government agencies to engage with development partners to secure their financial and other support. On-the-ground mainstreaming, on the other hand, is about reducing context-specific risks, managing residual risks and/or building resilience of targeted communities, including integrating climate risk considerations into economic, social and environmental development projects. On-the-ground initiatives produce clearly specified outputs, and at times specific outcomes, within a defined time period and budget.

Part 1 has presented a broad outline of how to mainstream climate risk into development planning and policy/project processes and on-the-ground initiatives. More details on the steps and the supporting tools are provided in the following sections. Part 2 focuses on strategic level mainstreaming, while Part 3 describes mainstreaming at the project level.

PART 2

STRATEGIC LEVEL MAINSTREAMING


PELAU ISLAND
Room 2
I'm OK- You're not OK
Room 4

PART 2. STRATEGIC LEVEL MAINSTREAMING

2.1. Introduction

This section of the guide provides a generic set of steps that can be used to integrate climate risk considerations at the strategic level, based on the combined policy cycle and climate risk management (CRM) framework described in Part 1.

It is assumed that a country already has in place strategic instruments to guide development. Climate risk considerations may be integrated into:

- A country's vision for its society and long-term development plan;
- National development policies;
- Medium-term development plans (or national strategic development strategies or equivalent, and respective medium-term sectoral plans);
- Corporate/agency plans which define medium-term and annual programmes of work, operationalising government national and sectoral /cross-sectoral policies;
- Enabling institutional designs, including legislations and other instruments.

A mainstreaming exercise at the strategic level normally results in several linked outputs. These could include a national climate change policy linked to the country's national sustainable development strategy (NSDS), its climate change strategic action plan and/or enabling legislation, or a national food security policy where climate change risks have been incorporated into the key strategies of the policy. A national plan complements the sector plans which are implemented by the government through their agency-level corporate plans. The policy may be given effect in legislation, regulations and bylaws.

The mainstreaming exercise is based on the seven-phase policy cycle described in Part 1:

1. Preparatory;
2. Situation analysis;
3. Problem analysis;
4. Solution analysis;
5. Design;
6. Implementation, monitoring and evaluation;
7. Review, feedback and adaptive management.

To mainstream climate change, these phases incorporate explicit considerations of climate risk supported by the following technical analyses:

A. Weather and climate hazard assessment;

B. Vulnerability assessment;

C. Disaster risk analysis;

D. Identification of risk reduction and adaptation strategies and measures;

E. Risk reduction analysis;

F. Evaluation and selection of preferred measures.

Drawing on reports produced by OECD (2009) and UNDP (Olhoff and Schaer, 2010), Figure 2.1 shows the seven-phase cycle (including technical analysis steps from the CRM framework), and expected outputs from mainstreaming at the strategic level. Each strategic level mainstreaming exercise will be different, in terms of geographic, thematic and temporal scale and scope of the exercise, stakeholders involved, and the types of information and analysis required. However, these steps can be adapted and usefully applied in many different situations.

FIGURE 2.1. The mainstreaming framework, and expected outputs.

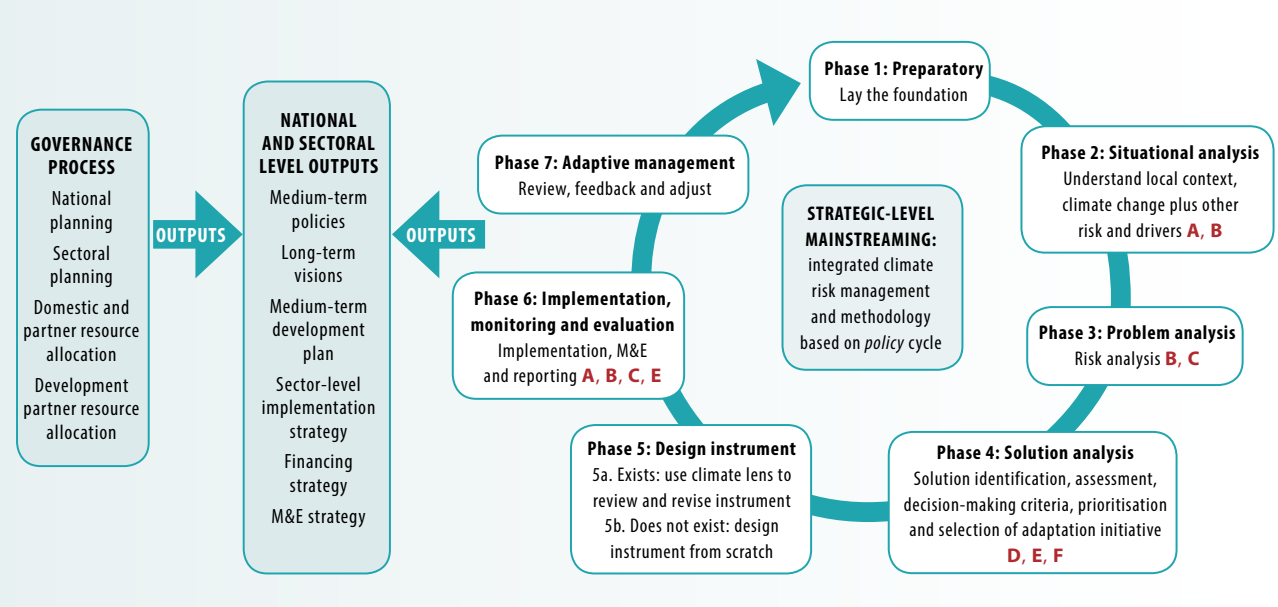
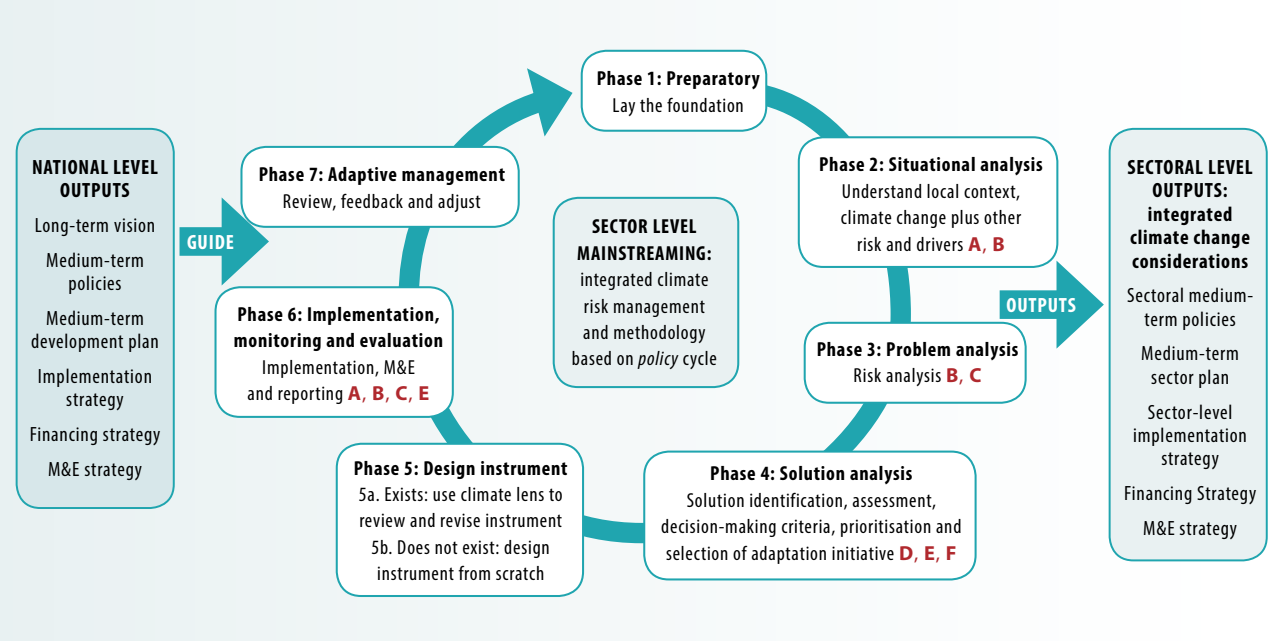


Figure 2.2 depicts the how the national-level outputs inform the sectoral-level mainstreaming exercise, producing sectoral-level instruments. The sectoral-level strategic instruments where climate risks have been mainstreamed will then guide the corporate-level strategic plan.

FIGURE 2.2. Relationship between outputs of national and sectoral level mainstreaming exercises. (Adapted from Olhoff and Schaer (2010), Figure 1.)



2.2. Step-by-step guide

This guide presents a seven-phase mainstreaming exercise aligned with the seven phases of the strategy or policy development cycle. While the step-by-step process described suggests a sequential progression through the phases, in fact many steps, particularly the early phases 1–4, may be undertaken simultaneously. It may also be necessary to revisit and repeat some of the steps, for example if more information becomes available.

Phase 1 – Preparatory

PURPOSE: Establish an institutional foundation for the mainstreaming exercise, cooperation across different government agencies, communities, and all stakeholders, and a platform for collective decision making.

The preparatory phase ensures that the multifaceted nature of climate risk management is adequately addressed, bringing together different arms of the government and other stakeholders to make informed collective decisions drawing on the best available scientific and experiential knowledge. Encouraging the engagement of different arms of government, operating under their respective legislation, requires support from higher levels of government. To facilitate such a cross-sectoral engagement, there is a need to secure appropriate political and stakeholder support at the earliest stage possible. This helps to:

- integrate climate risk considerations in a systematic manner across key government decision-making processes;
- secure inputs from different arms of the government and other stakeholders so collective decisions are made across all stages of the mainstreaming exercise – emphasising the point that climate change is everyone's business and a national systems approach to climate risk management is essential;
- coordinate access to data maintained by different arms of government and scientific groups – to make informed decisions, interdisciplinary data, information and knowledge sets are required.

This preparatory phase thus helps to lay the political, organisational and institutional foundation to operationalise the mainstreaming exercise. This phase involves five steps.

PHASE 1 STEPS	EXPECTED OUTPUTS
1.1 Raise awareness 1.2 Establish stakeholder support, including political support 1.3 Establish appropriate institutional arrangements, including government and non-government stakeholder engagement in the decision-making processes 1.4 Identify types of scientific information, analysis and expert support that may be relevant 1.5 Identify strategic level for mainstreaming	• Improved understanding and secured political support • Secured cross-agency and other stakeholder engagement and support • Interagency committees and stakeholder groups established to guide and support mainstreaming • Technical committee established to help access and analyse data and provide technical inputs • Products of mainstreaming exercise objectively identified • Decision-making processes established that encourage active engagement of community members and sharing of their experiential knowledge

Step 1.1. Raise awareness

Awareness-raising must be clear about who the target audience is and what types of information best suit them. User-friendly information is needed about the impacts of climate change, what can be done to reduce the risks, and how people can help.

Step 1.2. Establish stakeholder support, including political support

The mainstreaming exercise has to engage key stakeholders across society. The involvement of government and non-government agencies will vary depending on the strategic level being targeted, as well as the inputs required.

In the Solomon Islands, for example, in the development of their National Climate Change Policy, faith-based organisations who are actively implementing adaptation initiatives were consulted and were among the participants in one of the many nation-wide consultation workshops. Consultations were also held with private sector companies. Their views were sought about possible changes in development processes, including environmental impact assessments (EIA) that the government may consider as part of the response to climate change.[1]

Gaining political support from the highest level in government is also critical for mainstreaming. An example of how to engage government agencies (ministries and departments) comes from Tonga. In July 2009, the National Emergency Management Office (NEMO) requested SOPAC to help develop a National Action Plan (NAP) on Disaster Risk Management (DRM). Separately, the Ministry of Environment and Climate Change (MECC) began developing Tonga's second national communication with the help of SPREP. With guidance from SPREP and SOPAC, the two agencies decided on a joint plan, merging their planning process efforts. As a result, the Government of Tonga Cabinet established the Joint National Action Plan (JNAP) Task Force, comprising the Climate Change Technical Working Group (Climate Change TWG) and the DRM Task Force.

'Champions' can be vital for success of the mainstreaming exercise. Government champions may come from different agencies, as shown below:

- Cook Islands: The Director of the Emergency Services and the Director of Environment (before Climate Change Cook Islands was established in the Prime Minister's Office) jointly led the JNAP process.
- Nauru: Coordinators of PACC and IWRM projects jointly led the sector-level mainstreaming, supported by the Secretary of the Department of Commerce, Industry and Environment.
- Tonga: The Director of the Ministry of Climate Change and Environment and the Director of the National Emergency Management Office, with the support of the Honourable Minister for Climate Change and Environment, led the mainstreaming exercise.
- Tuvalu: The Permanent Secretary of Foreign Affairs, Trade, Tourism, Environment and Labour and PACC coordinator, supported by Department of Environment officials, led Tuvalu's mainstreaming exercise.
- Vanuatu: The Director of Meteorological Services led development of the national action plan for DRM, with the National Disaster Management Officer.

Local champions can also play an important role, for example helping to raise awareness in the community about climate change, and can act as focal points for other partners to secure greater local ownership, channel information and build capacity. Examples include:

- Cook Islands: Strong involvement of the Cook Islands Red Cross in the JNAP process.
- Nauru: Strong support from community-based organisations and the media in the mainstreaming of climate risks in the development of an integrated water and sanitation policy.
- Tonga: Strong involvement of the Tonga Red Cross, Radio Tonga and Tonga NGOs organisation TANGO in their JNAP process.
- Tuvalu: Strong involvement of national media plus representatives from communities in the JNAP development process.
- Vanuatu: Strong support from the Vanuatu Broadcasting and Television Corporation in raising awareness about the importance of climate and other risk management.

Each stakeholder group may play several roles during the mainstreaming exercise, as summarised in Table 2.1.

[1] Source: Casper Supa, PACC coordinator, Completed country template on mainstreaming (July, 2012).

TABLE 2.1. Stakeholder groups and their likely roles at different phases of the mainstreaming exercise

STAKEHOLDER GROUP	STAGE OF ACTIVE INVOLVEMENT	LIKELY KEY ROLES
Government agencies	Phases 1 to 7, through membership of steering and technical committees	Joint ownership and partnership. Collective decision-making about risks, risk reduction and risk management
Department of Meteorology	Phases 1 to 7, through membership of steering and technical committees	Source of primary data on weather and climate; scientific expertise on climate change, analysis and modelling
National Disaster Management Office	Phases 1 to 7, through membership of steering and technical committees	Source of primary data on disaster events, impacts and response capacity; knowledge about disaster management
Ministry of Development Planning and Aid Coordination	Phases 1 to 7, through membership of steering and technical committees During design phase 6, and costing of plans and programmes	Source of primary information about the economy, planning and budgetary processes; cross-sectoral NSDS coordination; technical support
Prime Minister's Office	Phase 1, during government's approval process (through Cabinet and Parliament)	Political support; enabler for cross-sectoral and cross-agency collaboration
Ministry of Environment and Climate Change	Phases 1 to 7, through membership of steering and technical committees	Usually the lead agency, coordinator of the mainstreaming exercise in the country Source of primary information about international and regional dimensions of climate change debate and instruments The Climate Change Ministry would be involved with other sectoral level agencies, to guide them in the mainstreaming of climate risks in their sectoral/corporate planning process
Ministry of Agriculture and Livestock	Phases 1 to 7, through membership of steering and technical committees During agriculture sector mainstreaming exercise	Source of primary data on agricultural economic activities, and knowledge about the effects of climate on human livelihoods and food security
Ministry/ Department of Energy **Government's utility corporation**	Phases 1 to 7, through membership of steering and technical committees During energy sector mainstreaming exercise	Source of primary information about energy demand and supply, renewable energy, climate change mitigation
Provincial/local governments	Phases 1 to 7	Usually the lead agency for coordinating mainstreaming exercise at the provincial/local level with the guidance of the Ministry of Environment, producing provincial/local level plans and programmes
Non-government organisations and other stakeholders	Phases 1 to 7: through membership of steering and technical committees	Source of local level practical knowledge of development needs and vulnerability based on their practical experience of working with local communities, including in disaster risk management

TABLE 2.1. *Continued*

STAKEHOLDER GROUP	STAGE OF ACTIVE INVOLVEMENT	LIKELY KEY ROLES
Faith-based organisations	Phases 1 to 7, as members of stakeholder consultation groups, and as participants during workshops Mainly Phases 5 to 7: Design of on-the-ground strategies and programmes	Practical experience in supporting local communities particularly in times of natural disasters
Civil society – representatives from women's groups and youth organisations	Phases 1 to 7, through participation during stakeholder workshops	Active engagement and empowerment Practical experience in dealing with local communities supporting development and disaster management activities
International NGOs, e.g. Save the Children, Red Cross	Phases 1 to 7, through participation during stakeholder workshops	As members of wider stakeholder consultation groups
Private sector	Phase 1 and others, particularly Phase 5	Provide inputs regarding effects of disasters on the private sector and the likely impact of changes in government policies, rules and standards
CROP agencies (SPREP, SPC-SOPAC)	Throughout the process, including as technical backstops	As members of technical group and/or wider stakeholder consultation groups
Development partners – multi-lateral and bilateral	Particularly Phases 1, 5 and 6	During Phase 1 to secure financial and technical support for the mainstreaming exercise As members of wider stakeholder consultation groups As potential donors and partners for the implementation Phase 6
Colleges of Higher Education, University of the South Pacific	Phase 1 and subsequent capacity development programmes	As trainers at different levels

Step 1.3. Establish appropriate institutional arrangements

A strong cross-agency and stakeholder-based decision-making body is required to support technical aspects of the mainstreaming exercise, as well as the decision-making and approval process. Examples include:

- Fiji: A National Environment Council subcommittee served as the high-level 'political' steering committee, as well as provider of technical knowledge, during the development of Fiji's Climate Change Policy;
- Nauru: A political-level steering committee, comprising heads of departments, was set up to guide water policy and the Nauru Water, Sanitation and Health Plan;
- Tuvalu: A Cabinet Development Subcommittee served as the political-level steering committee for development of the country's Climate Change Policy and Climate Change Strategic Action Plan.

A steering group comprising heads of departments can help to provide political-level support. This makes it easier for the lead agency to get inter-agency support, and to steer the output through government approvals. Where such mechanisms do not exist, a new committee could be established, as was done in Nauru. A subset of this steering body may form a technical working group.

Step 1.4. Identify types of data, information and expertise required

Integrating climate risk considerations into development requires access to a body of scientific and experiential knowledge, including:

- Current weather and climate conditions and historical trends;
- Economic development conditions and poverty;
- Human development characteristics;
- Natural resource and environmental characteristics;
- Natural disasters, historical trends and their impacts;
- Projected climate conditions and scenarios;
- Current vulnerabilities and drivers of vulnerability;
- National, regional and international policy instruments.

These data and information may be accessed from a diverse range of sources, as illustrated in Box 2.1 (next page) for national mainstreaming exercises in Fiji and Tonga. A cross-disciplinary team of technical experts, or a technical working group, could provide additional disciplinary and interdisciplinary analytical advice. A technical working group may include experts such as economists, sector specialists, climate change scientists and environmentalists, as well as people with practical and experiential knowledge, such as disaster risk management officers and community members.

Step 1.5. Decide on strategic level for mainstreaming

The mainstreaming process can focus on national, sectoral or more local levels. Choice of level here also refers to whether the mainstreaming exercise aims to 'climate-proof' an already existing strategic instrument, or whether the intention is to create a new policy instrument which fully integrates climate risks.

This step allows countries to select a mainstreaming level appropriate to their planning horizon and resources. For example, some countries develop just one national-level strategic document, linked to the National Sustainable Development Strategy, to guide DRM and climate change adaptation and mitigation. This joint national action plan (JNAP) approach was decided by Tonga to "avoid duplication of effort and to maximise the use of the limited resources in Tonga" (Government of Tonga, 2010). Tuvalu took a similar approach under their PACC project, with Integrated Water Resource Management (IWRM) and the Second National Communication. Under this approach, it is then left to each sector and agency to integrate the relevant strategy/action from this national level strategic document into their sector policy and annual action plan.

BOX 2.1. BACKGROUND MATERIAL USED IN MAINSTREAMING EXERCISES IN FIJI AND TONGA

MAINSTREAMING OUTPUT (NATIONAL LEVEL)	FIJI	TONGA
	NATIONAL CLIMATE CHANGE POLICY	JOINT NATIONAL ACTION PLAN
International context	International and regional frameworks on climate change (UNFCCC and PIFACC) and development (MDGs and Mauritius Strategy for Implementation)	International and regional frameworks on climate change (UNFCCC and PIFACC), Yokohama Plan of Action and HFA
Regional context	PIFACC and Pacific Plan Advisory Committee (PPAC)	RFA on DRR and DM, PIFACC and PPAC
National context	People's Charter strategies on environment, food security and governance	National Strategic Development Framework Goal 7 on the integration of environment sustainability, climate change, and disaster risks into national plans and programmes
National development status	Spatially distributed information on geography, population and economic and social development status Sourced from different reports and agencies, including national development reports and MDG reports	Spatially distributed information on geography, population (density and distribution), economic and social development status, and trends National economy structure and GDP share Sourced from different reports and agencies, including national development reports and MDG reports
Climate and climate-induced hazards and impacts	Climate variability due to ENSO, South Pacific convergence zone, trade winds, and seasonal trends Information obtained from a diverse range of agencies, such as Fiji Bureau of Meteorology, CSIRO and Australian Bureau of Meteorology, CROP agencies, and other global literature	Climate variability due to ENSO, South Pacific convergence zone, trade winds and seasonal trends Climate-related hazards, such as cyclones and storm surges Impact assessment of variability and extreme weather and climate events on key sectors Information sourced from a diverse range of agencies such as Tonga Meteorology Services, reports from CSIRO and Australian Bureau of Meteorology, CROP agencies, and National Disaster Management Office
Climate trends	Current trends in rainfall, maximum and minimum temperature, sea surface temperature, mean sea level, extreme events such as tropical cyclones, drought, floods, storm surges and sea flooding Information obtained from Fiji Bureau of Meteorology, reports from CSIRO and Australian Bureau of Meteorology and other global literature	Rainfall, maximum and minimum temperature, sea surface temperature, mean sea level, climate-induced hazards and trends, including cyclones and storm surges Information obtained from a diverse range of agencies such as Tonga Meteorology Services, reports from CSIRO and Australian Bureau of Meteorology, CROP agencies, and National Disaster Management Office
Climate projections	Information obtained from IPCC AR4 report, CSIRO and Australian Bureau of Meteorology. These climate change projections are based on global climate models and statistical downscaling providing estimates of key climate parameters	Information obtained from IPCC AR4 report, CSIRO and Australian Bureau of Meteorology. These climate change projections are based on global climate models and statistical downscaling providing estimates of key climate parameters
Disasters	Not included	Geological hazards, documenting incidence of earthquakes and their impacts; volcano and tsunami
Sources:	*Based on Government of Fiji (2012)*	*Based on Government of Tonga (2010)*

Reviewing past and current DRM and climate change initiatives together with existing strategic instruments helps to identify the level that needs to be targeted. Countries may choose to adapt existing national plans, develop a national policy and plan where none exists, or focus on sectoral-level mainstreaming.

In Vanuatu, changing the national development plan, the Prioritised Action Agenda (PAA), was not feasible, as the country had only recently approved the PAA for 2006–2015. Instead, a supplementary PAA was developed with the goal of reducing risk and building resilience. This emerged at the same time as the National Action Plan (NAP) for DRR and DM, and was endorsed by the government. The PAA was reviewed in 2010–2011 and a 'PAA 2012 update' was produced, with DRM and climate change issues included.

A national-level policy may not exist, and the commitment to develop one may be difficult to secure. If this is the case, countries may decide to focus on the practical dimension at the sectoral level, incorporating challenges of climate change and DRM as part of a broader sectoral policy and implementation plan. An example comes from Nauru (Box 2.2).

BOX 2.2. WATER, SANITATION AND HEALTH POLICY DEVELOPMENT AND MAINSTREAMING CLIMATE CHANGE

The Nauru Government recently approved a water, sanitation and health policy developed under a GEF-funded Integrated Water Resource Management (IWRM) project with the support of PACC. This focused on one of the water and sanitation strategies listed in the NSDS. The IWRM and PACC project coordinators formed an informal 'water unit' to help coordinate their work. This occurred in the absence of a national climate change policy, or any similar document other than the NSDS and the infrastructure plan.

Nauru had prepared a NAPA as part of their second communication requirement, called RONADAPT in 2010. This was later updated in early 2012 (Nauru Department of Commerce Industry and Environment, 2012). The team combined three separate goals under the NSDS 2005–2025 to produce a vision for the policy: Reliable, safe, affordable, secure and sustainable water supplies to meet socio-economic development needs and appropriate sanitation systems for healthy communities and environments. In the development of the water policy and plan, some ground had been covered during the RONADAPT process.

Different paths were used by Fiji and Tuvalu. With support from the PACC project, Tuvalu developed a National Climate Change Policy linked to its Te Kakeega II. They also developed their National Strategic Action Plan (NSAP) for Climate Change and Disaster Risk Management, 2012–2016. The NSAP is the Implementation Plan for the National Climate Change Policy, Te Kaniva (Government of Tuvalu, 2012a,b).

The Fiji Cabinet endorsed the National Climate Change Policy Framework in 2007. The Framework defined the position and responsibilities of the government and other stakeholders on the issues of climate change, climate variability and sea level rise. The framework was reviewed in 2011, and a revised policy endorsed in 2012. Fiji then developed a National Climate Change Adaptation Strategy for Land-Based Resources 2012–2021 (draft), with the assistance of GIZ and SPC through their regional programme 'Coping with Climate Change in the Pacific Island Region' (CCCPIR).

Box 2.3 describes the rationale adopted by Kosrae, Federated States of Micronesia, to amend their State Code 19 legislation.

BOX 2.3. GAPS IDENTIFIED BY KOSRAE, FSM, BEFORE DEVELOPING THEIR CLIMATE CHANGE LEGISLATION AND AMENDING EXISTING STATUTES

- FSM climate change (CC) policy 2009 needs to be given effect
- Absence of CC legislation or legally binding instrument
- Lack of CC strategic and policy direction
- Disconnect between stakeholders (resource users, developers, policy makers, communities)
- Lack of information about climate change impacts tailored to the needs of the people
- Need to coordinate CC programmes in FSM
- Need help to attract development partner funding

Source: Based on completed country template for mainstreaming by PACC Coordinator (August 2012)

Agencies should ultimately integrate climate risks into their medium-term corporate and annual plans. For example, when Vanuatu's Public Works Department (PWD) reviewed its corporate plan, climate risks were included (Box 2.4).

BOX 2.4. RELATIONSHIP BETWEEN VANUATU'S PAA, 2006–16 (2012 UPDATE), PAA ACTION PLAN STRATEGIES AND PWD'S CORPORATE PLAN, 2011 (REVISED)

NATIONAL STRATEGIC PRIORITY 4: PRIMARY SECTOR DEVELOPMENT, ENVIRONMENT, DISASTER, CLIMATE CHANGE, DRM			
PAA Action Plan Priority Objective[1]	PAA Action Plan Strategy[1]	MIPU Corporate Plan, 2011[2]	PWD agency-level strategy – integrating climate risk in its revised corporate plan[2]
PO 4.5 Ensure the protection and conservation of Vanuatu's natural resources and biodiversity, in view of climate change issues	Strategy 4.5.5 Finalise and implement the Vanuatu climate change policy, and integrate it into the PAA, sector plans and ministry corporate plans	Objective 1: Ensure the provision of commercial, quality, reliable, safe, efficient and competitively priced infrastructure, utilities and services, through public or private enterprises	Within 10 years, 1800 km of road are upgraded and sealed Within 10 years, all 26 outer island airport runways are upgraded to an all-weather surface and new airports constructed where necessary
PO 4.6 Prepare the people of Vanuatu to face disasters	Strategy 4.6.1 Strengthen planning and decision-making at national and provincial level for DRR/DRM		

Sources: [1] Government of Vanuatu (2012); [2] Ministry of Infrastructure and Public Utilities (MIPU 2012)

A government's decision about the level to target for mainstreaming climate change depends on country priorities and resource constraints. At times, the national and sectoral levels may be targeted together. A discussion of issues such as those described in Table 2.2 can help to confirm the most effective approach.

TABLE 2.2. Types of questions for guiding which level of mainstreaming to target first

National and/or sectoral-level mainstreaming exercise:

- Does the NSDS refer to disaster risk management and climate change?
- Is there a national policy on DRR and DM, and/or CC to guide efforts across sectors and agencies?

Sectoral and corporate-level mainstreaming:

- Which sectors are most sensitive to climate change?
- Which ones have sectoral policies and what climate (and other disaster) risks can be identified?
- What assessments have been completed as part of DRM and climate risk management initiatives?
- Can you identify any local champions who could drive the climate change mainstreaming process?
- Can you identify development partners who may support sector-level mainstreaming exercises?

Mainstreaming enabling legislation

- What gaps can be identified in legislation, regulation and codes of practice to address climate change?

Phase 2 – Situation analysis

PURPOSE: Understand the development context, current weather and climate risks, and projected climate change scenarios.

This phase involves the following steps and expected outputs:

PHASE 2 STEPS	EXPECTED OUTPUTS
2.1 Understand the country's development context 2.2 Understand current weather and climate risks 2.3 Understand projected climate change scenarios	A status report on: • economic, social, and environmental context, together with institutional and political environment • current weather and climate context • projected climate change scenarios

Step 2.1. Understand the country's development context

Understanding the social, economic and environmental context is essential for a successful mainstreaming exercise. Combined with an understanding of the local governance and political decision-making process, this helps to place risk and risk reduction assessments into context. The poorer the economic and social well-being at the household level, the more vulnerable the household, economy and society will be to external shocks. At the same time, the nature of development within a country affects its vulnerability to disasters. For example, coastal developments are very exposed to the effects of cyclones, increasing vulnerability of assets and communities to these natural disasters. Hard coastal structures, like sea walls, themselves could increase the risks of coastal erosion nearby. Unsustainable development practices, such as logging in areas prone to landslides, increase disaster risks. Environmental degradation is also a major driver of disaster risk, by aggravating the impact of hazards.

The development agenda followed by a government affects the risks and required risk reduction strategies, particularly when cross-sectoral effects are not considered in development decisions. As the effects of climate risks take multiple pathways, they are not easy to predict; sound multidisciplinary scientific and experiential knowledge and cooperation across sectors and agencies are essential to inform key decisions. Human vulnerability is heightened by weak disaster warning systems, and the limited ability of people to manage residual risks and respond to disasters. Other drivers of change that also influence disaster risks include increasing population, urbanisation, globalisation, and the loss of traditional knowledge.

A situation analysis can be undertaken as a desktop assessment, and guided by a series of questions summarised in Table 2.3.

TABLE 2.3. Questions to guide a situation analysis

Economic and social overview	• What are the key economic and social development conditions and trends – for example, economic growth, income distribution and poverty, social conditions such as education level, health status, and access to clean water and sanitation – disaggregated by gender and spatially where such information is available? • What are the recent trends in other drivers of risks, such as population growth and population distribution, including urbanisation and the status of such settlements?
Resource and environmental context	• What is the condition of the environment, and resources such as coastal fisheries, forests, fresh water, mangrove forests, coral reefs, and biological diversity? Which of these environmental resources are, or are under serious threat of, being overexploited and degraded, affecting people's development opportunities and increasing their vulnerability to climate change? • What is the status of natural resources-based economic activities, such as agriculture, fisheries and forestry?
Governance context and decision-making processes	**Regional and international context** • Which international and regional instruments is the country party to? For example, the UNFCCC and the HFA and their respective regional plans of action, and the CBD at international level; the Pacific Plan, Peer Review Assessments and reporting under the Forum's Cairns Compact at regional level (PIFS, 2009). • Which of these instruments does the country regularly report on, and what reports have recently been submitted (including those in draft forms)? • When is the next cycle of communication to UNFCC, report against the PIFACC and Pacific DRR&DM FA and Pacific Plan, and next MDG report submission due?
	National planning and governance context • Does the NSDS include specific goals on climate change and disaster risk management, such as creating a safe, secure and resilient society? If not, where in the NSDS is the issue of resilience and security captured? • What is the country's NSDS planning process, and when is the next planned NSDS review?
	Economic development and poverty reduction instruments • What major policies, plans, or programmes, either established or upcoming, relate to poverty reduction, and thus have bearing on the assessment of vulnerability to climate change? • What institutions are responsible for funding and implementing them?
	Sector policy and planning instruments • Which sector plans currently exist in the country? • Which of these are climate relevant? Is disaster risk/climate vulnerability covered in the sector policy or plan, where they exist? • What sectoral planning process has been used in-country? • When are the sector plans expected to be revised?
	Policy assessment planning tools • What environmental planning tools or processes are currently in use, e.g. strategic environmental assessment (SEA)? • Does the country subject its draft policy and/or development plans through an SEA process and at what stage? How effective have these processes been? • What institutions are involved in the SEA or similar tools?

Disaster and CRM-related policies, plans or programmes	**Disaster risk management policies and plans** • What major policies, plans, or programmes, either established or upcoming, relate to disaster risk reduction? What institutions are responsible for funding and implementing them? • Who coordinates disaster risk reduction and/or disaster management and what processes are used?
	Climate change policies and action plans • Which climate change related policies currently exist in the country and how do they relate to the NSDS, sector plans, and/or DRM action plans? • Is this harmonised with DRM policies and plans?
Organisation and institutional mapping	• Which government agencies have legislative mandate (and under what legislation), and what processes do they follow, to address: – Disaster risk reduction and disaster risk management? – Climate change as a development issue? – National planning and budgeting process?
Development partner coordination	• What mechanism exists to support coordination of development partner assistance?

Step 2.2. Understand current weather and climate risks

This step is carried out by the technical working group established in Phase 1, with the help of local and regional meteorologists and climate science specialists, as well as the disaster management office and sectoral agencies. It helps to identify vulnerable communities, effects of past extreme events, and key gaps in risk assessments and response strategies. An overview report is produced on current weather and climate conditions, summarising data such as temperature, precipitation, wind, and sea level rise, and also documenting El Niño/La Niña events, depressions, cyclones, droughts, floods, storms, and coastal storm surges. The detail of such reports may depend on data that can be easily analysed, given capacity constraints. Box 2.5 shows an example of disaster statistics that could be used during this step.

BOX 2.5. AGGREGATE-LEVEL DISASTER IMPACTS STATISTICS FOR FIJI, 1970–2007

DISASTER	NUMBER OF EVENTS	NUMBER OF PEOPLE AFFECTED	NUMBER OF PEOPLE KILLED
Flood	41	221,724*	88
Tropical cyclone	63	791,653*	309
Earthquake	10	0	5
Drought	6	840,857	0
Tsunami	2	0	0
Severe local storm	2	8,369	17
Total	124	1,862,603	419

*Only for years when number of affected people was recorded; actual numbers could be much higher.

Source: Lal et al. (2009), compiled from EMDAT, Glide, Fiji Meteorological Services

Step 2.3. Understand projected climate change scenarios

Understanding future climate change scenarios is at the core of climate risk management decisions. Climate science is a complex subject, and specialised knowledge and skills are limited in the Pacific, so the countries usually depend on modelling results available from international agencies. Until late 2011, global scenarios reported by IPCC were the main source of information for the Pacific. Since then, each country now has access to climate change assessments provided under the Australia-funded Pacific Climate Change Science Program (PCCSP); these can be obtained from the country's meteorological services, or accessed from www.pacificclimatechangescience.org.

Baseline data and information to support the situation analysis can also be obtained from a diversity of international, regional and national sources, as well as many websites maintained by international institutions such as the World Bank, ADB, WMO, FAO, and UNDP.

Phase 3 – Problem analysis: current and projected risk

PURPOSE: Understand the hazards and risks posed by current climate and by projected future climate, and gaps in current disaster risk management.

PHASE 3 STEPS	EXPECTED OUTPUTS
3.1 Analyse current weather and climate risks, other drivers of risks, including root causes 3.2 Assess gaps in current disaster risk management 3.3 Assess projected weather and climate risks, and other drivers of risks	A status report on: • Current weather and climate risks and other drivers of risk and root causes • Gaps in disaster risk management • Projected climate risks and vulnerability

Step 3.1. Analyse current weather and climate risks

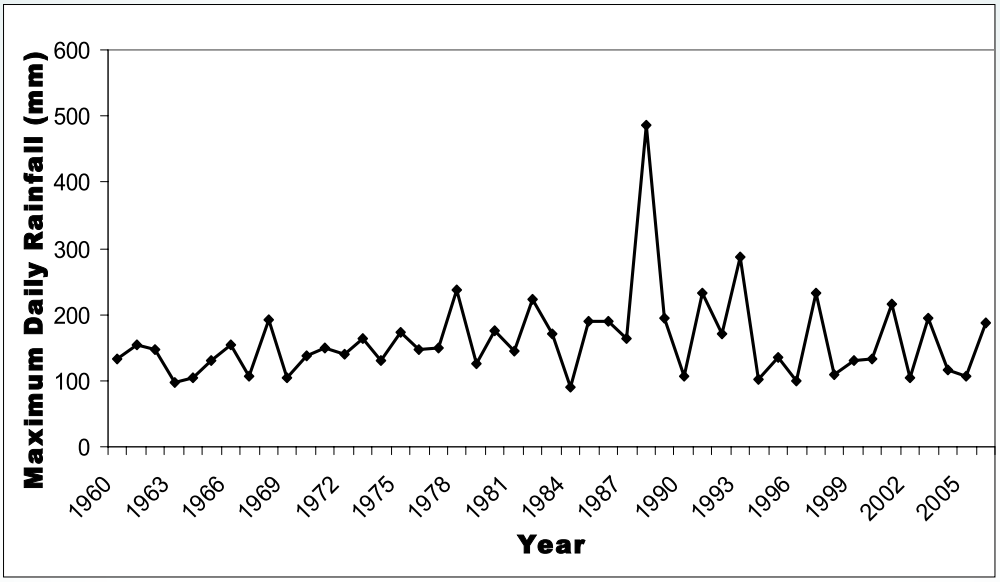
Climate risk analysis is about assessing the nature of hazards produced by weather events, and how they affect people.

Vulnerability assessment focuses on communities and their vulnerability. This is often the most appropriate starting point in the Pacific, given the constraints of poor data, limited impact models, and capacity. The 'vulnerability first' approach has several features:

- Identifying current weather and climate events that produce hazards, and creating hazard maps;
- Identifying areas, communities and activities that are most sensitive to specific hazards, and assessing the communities' ability to cope and rebuild;
- Documenting root causes of vulnerability, e.g. poverty or living in a hazard-prone area.

Such assessments draw on information collected in Phases 1 and 2 about frequency of past disaster events, number of people affected or killed, damage and loss estimates, as well as social, economic and environmental status. Data and analyses can be presented in different ways to help stakeholders understand current and projected risks. Box 2.6 shows two different ways historical weather data were summarised to demonstrate recent changes in climatic events and help understand potential future changes in Samoa.

BOX 2.6. SOME OPTIONS FOR WEATHER AND CLIMATE DATA PRESENTATION (SAMOA)



Above: Maximum daily rainfall per year, for Apia, 1960–2006

Below: Return periods in years or changes in hazard conditions: daily rainfall in Apia.

DAILY RAINFALL OF AT LEAST	1960–1979	1980–2006
200 mm	11.6	3.0
250 mm	60	5.5
300 mm	318	10
350 mm	1700	21

Vulnerability assessments are normally presented as disaster or climate risk profiles, such as those under the PCRAFI project (see http://pcrafi.sopac.org/). Country disaster risk profiles are available from the Pacific Risk Information System (PaRIS) database, contained in the Pacific Risk Information System also accessed through the PCRAFI website.

Climate risk assessments can also summarise the impacts of past extreme events in terms of number of people/properties affected, value of affected infrastructure, assets, capital by hazard type (as shown in Box 2.7); such empirical information can be very powerful when trying to convince governments in particular to take action.

BOX 2.7. PROJECTED ECONOMIC LOSSES FROM INCREASED INTENSITY OF TROPICAL CYCLONES – FIJI

MEAN RETURN PERIOD (YEARS)	50	100	250
Direct losses			
USD million	342	405	484
% GDP	10	12	14
Emergency losses			
USD million	79	93	111
% GDP	8	9	11

Source: Government of Fiji (2012 (draft))

In this phase, further detailed analysis can also be carried out to understand root causes and other underlying drivers of risks, such as poverty, poor resource management, poor development and urbanisation.

Step 3.2. Assess gaps in current disaster risk management

Gaps are assessed in disaster risk reduction and management systems to help communities prepare for climate risks. Such gaps may relate to early warning systems, baseline information or poor coordination of government activities. There may also be gaps in the enabling environment, such as building codes, legislation, insurance options, or financial resources.

Step 3.3. Assess projected weather and climate risks

This step builds on the climate risk assessment described earlier, and focuses on the effects of projected climatic conditions. That is, it extends the previous analysis of current weather and climate risks to focus on expected impacts and vulnerability under the changed climatic conditions. The assessment uses data and information sets collected during the preparatory phase and subsequent phases, and submits them to analysis using different analytical tools, including climate models, vulnerability assessments, and risk profiling.

The identification of current weather and projected climate risks is based on technical analysis A, B, and C during Phases 2 and 3 (see Figure 1.4). The level of analysis conducted depends on factors such as:

- The availability of baseline data;
- Past research and assessments already undertaken, for example, for the NAPA, NAPs, etc.;
- Availability of country-specific climate change scenarios and disaster risk profiles;
- Availability of expertise and resources for further assessments, including local and externally sourced capacity.

This step helps decision makers understand the relationship between climate change, risks and potential impacts of climate change on livelihoods and other measures of well-being.

Box 2.8 describes a community-based vulnerability assessment carried out by ADB using a range of scientific data sources and analytical tools, and drawing on a range of expertise.

BOX 2.8 COMBINING SCIENTIFIC INFORMATION AND COMMUNITY-BASED INFORMATION IN THE COOK ISLANDS

The Asian Development Bank (ADB) carried out a community-based vulnerability and adaption (CV&A) assessment exercise in four villages on two of the Cook Islands. Results of a 2004 ADB project, the Climate Change Adaptation Project for the Pacific (CLIMAP), were used as a baseline for the project. The community mapping exercise used hand-held GPS units, photographs and household surveys to map household-level vulnerabilities. The GPS data were converted into GIS layers and integrated with government GIS maps. The maps included data such as elevation, infrastructure, land use and land cover, and geology; and socio-cultural data, primarily of significant cultural sites. Other data layers were also incorporated, including remote sensing imagery and GIS layers on the hydrology, physical features, and biotic communities of the project sites.

A household survey gained a picture of the vulnerability of individual households. Stakeholders decided which risks were important and identified priority adaptation options. The communities rated the risk levels from minimal to high, and the severity of impacts on a scale of 1 to 5. This process helped to identify priority risks and their adaption strategies, taking into account the needs and priorities of the local people and their traditional knowledge.

Source: ADB (2011)

Key tools used to assess risks during this step are summarised in Table 2.4. When risks are understood and quantified, this information then informs the adaptation pathway and adaptation measures for consideration and further assessment in Phase 4.

TABLE 2.4. Tools commonly used to assess climate risk in the Pacific.

TYPE OF ASSESSMENT	TOOLS USED IN THE PACIFIC	KEY REFERENCES
Climate change modelling and sea level scenario analysis and impact assessment	Global Climate Models; dynamic and statistical downscaling of climate projections SIMCLIM: CoastClim of Simulator of Climate Change Risks and Adaptation Initiatives	IPCC AR 4 (IPCC, 2007) BOM and CSIRO (2011) www.climsystems.com Warrick (2007)
Vulnerability assessments and drivers of risks	Community vulnerability and adaptation assessment (CV&A) Community-based vulnerability assessment and adaptation planning using hand-held GPS and GIS Vulnerability risk assessment (VRA) Driver-pressure-state-impact response (DPSIR)	Nakalevu (2006) ADB (2011) Droech et al. (2008 (Dec)) Kuldna et al. (2009) NZ Ministry of Environment (2011)
Stakeholder-based participatory process. This analysis will help identify/confirm development, environmental issues, disaster and climate risks, their underlying root causes (and their potential solution options covered in Phase 4)	Root cause/solution tree analysis Problem/objective tree Log frame to organise the problem/ solution responses	Government of Tonga (2010) Pacific Disaster Risk Management Partnership Network (2009)

TABLE 2.4. *Continued*

TYPE OF ASSESSMENT	TOOLS USED IN THE PACIFIC	KEY REFERENCES
Disaster risk assessment	CHARM	SOPAC (2002)
Sector-level impacts	PlantGro (agriculture) WATBAL9F (water resource) Cook Islands Coastal Calculator	Topoclimate Services Ltd and CLIMSystems (2005) Hackett and Vanclay (1998) Ramsay (2012)
Selection of options and prioritisation	Multi-criteria analysis	Government of Nauru (2012c) Department of Communities and Local Government (UK) (2009) Brown and Corbera (2003)

Phase 4 – Solution analysis and identification of adaptation options

PURPOSE: Identify options to reduce the identified climate risks.

PHASE 4 STEPS	EXPECTED OUTPUTS
4.1 Select adaptation pathway 4.2 Identify relevant adaptation strategies and measures 4.3 Prioritise strategies and select preferred adaptation measures	• Brief report outlining process followed and basis for identifying main options • Key adaptation and development measures identified for further analysis • Key adaptation measures analysed using cost–benefit analysis and/or other assessments, and preferred option(s) selected

There is more than one way to address a climate risk, and it is important that all feasible options are identified and properly considered in order to allow for the most appropriate option to be selected.

Step 4.1. Select adaptation pathway

Decisions about the balance between the three pillars of sustainable development (economic development, social development and environment conservation) are implicitly made when government agencies allocate their budgets and decide which areas to support, or when they respond to development partner interests. A more explicit discussion can help countries to identify development pathways that reflect disaster risk considerations as well as meet current and projected development needs. Stakeholders may decide, for example, to select one or more of the following pathways:

- Improve economic and social development, which can help reduce vulnerability and drivers of vulnerability, such as environmental degradation, poverty or access to water and sanitation;
- Improve resource and environment use and management, adopting 'no regrets' measures that, for example, help reduce the chances of landslides, flooding or coastal fisheries collapse;
- Develop adaptive capacity – by increasing assets (human, social, financial, physical, and natural) and institutional function (policies, early warning systems, etc.).

The criteria used to decide on the balance between the different pathways will be based on information compiled from the situation analysis carried out in Phase 2 and the problem analysis in Phase 3, including:

- The status of human development and sensitivity of communities to climate variability;
- Current disaster risks and gaps;

- Local perception of current and projected weather and climate risks and the relative importance they place on addressing them; and
- Priority sectors where projected climate change risks must be urgently considered which may also coincide with current development needs.

Box 2.9 describes Nauru's approach to defining criteria and identifying adaptation options.

BOX 2.9. CRITERIA SELECTION TO GUIDE ADAPTATION OPTIONS IN NAURU

As part of its NAPA development process and using UNFCCC NAPA guidelines for Least Developed Countries (LDCs), Nauru identified its criteria for selecting adaptation options, and to help identify vulnerable communities and areas.

A Vulnerability and Adaptation Thematic Working Group prepared background information for each sector, which was consolidated by the NAPA team. Stakeholder workshops then identified six sectors to target: water resources, fisheries and marine resources, agriculture, coastal zones, human health and disaster management.

To prioritise the options, the stakeholders agreed the selection criteria should cover:

- Severity of adverse effects and the underlying vulnerability;
- Complementarity with existing projects, national development efforts, multi-lateral environmental agreements, and sustainable development goals as outlined in the NSDS;
- Culturally acceptable options owned by those affected;
- Cost-effectiveness, feasibility and viability;
- Increased community resilience to climate change, improved livelihoods and incomes;
- Enhanced capacity of communities and sectors to adapt to climate change;
- Equity – gender and resources;
- Sustainability in the long term.

Source: Nauru Department of Commerce, Industry and Environment (2012)

The choice of adaptation pathway may also reflect a country's assessment of the likelihood of obtaining additional development partner support, noting that a country may have multiple priority needs. Box 2.10 gives an example of Vanuatu's use of Australian aid to target improvement in its coastal roads for both economic and social development, and as part of its climate change adaptation agenda.

BOX 2.10. AUSAID'S SUPPORT TO VANUATU INFRASTRUCTURE

Australia provided Aus$17 million towards the Vanuatu Transport Sector Support Program, 2009–2012, as part of their assistance for improving economic and social well-being. Australia provided a further Aus$3 million to help climate-proof the roads, by improvement of planning, construction, and maintenance of priority road links on the islands of Ambae, Tanna and Malekula. This was justified on the basis that infrastructure in Vanuatu is extremely vulnerable to the impacts of cyclones, storms, heavy rains and flooding.

Source: AusAID (2010)

Step 4.2. Identify relevant adaptation strategies and measures

Adaptation responses include development strategies to reduce particular vulnerability and to directly address specific climate risks. A problem-tree analysis identifies key concerns, their root causes and drivers. Solutions identified may be sector specific or thematic. Problem-solution analysis is based on knowledge about ecological, social and economic processes, and may require disciplinary expertise and analytical skills. Tonga's approach to identifying specific goals, strategies and actions included in their Joint National Action Plan for DRM and CC is described in Box 2.11.

BOX 2.11. TONGA'S PROBLEM-SOLUTION ANALYSIS AND STRATEGIES TO ADDRESS CLIMATE RISKS

The Tonga Task Force, established during Phase 1 of the country's JNAP development process, identified priority climate factors for which detailed strategies and actions were needed. Stakeholders collectively identified general risks and their impacts in key sectors. Taking into account ongoing activities in the country, the stakeholders indentified areas where new actions/resources were required. These were considered as gaps to be addressed in the JNAP. The table is an extract from the JNAP report that provides an example of the types of adaptation measures identified by the Task Force for drought-related risks, based on collective analysis of issues by government and non-government agencies, sectoral subject matter experts, regional technical advisers and community knowledge.

SECTOR	IMPACTS OF DROUGHT	ADAPTATION OPTION
Water resources (water security)	Shortage of water, pollution and contamination	Expand water collection and water tanks Install solar panels on groundwater pumps Wise use of water Desalination machine
Agriculture	Loss of crops, decreased crop yield and food shortage	Plant drought-resistant crop varieties Irrigation Grow more fruit-bearing trees
Health	Water contamination, increase in diseases, and dust from roads	Increase public awareness Boil water before consumption Improve health care
Fisheries	Lagoon fisheries affected, shallow marine life killed	Raise awareness

Source: Government of Tonga (2010)

Countries with limited resources will address their immediate development needs and are likely to postpone decisions concerning future climate risks. Indeed, addressing current development needs is a good starting point for adaptation to future climatic conditions (IPCC, 2012); however, countries should ensure that they avoid increasing risks. The uncertainty of future climate hazards is also part of the decision-making process and needs to be explicit. This is sometimes done through the categorisation of options as 'no regret', 'low regret', and 'high regret' measures. Measures that will generate net benefits under many different climate change scenarios are considered to be 'no-regret' or 'low-regret' options; these often also involve low investment and are reversible (e.g. conservation and sustainable use of natural resources). Measures that generate net benefits only under certain

climate change scenarios are considered to be 'high-regret'; such measures are often also characterised by high investment costs and high irreversibility (e.g. large infrastructure projects such as sea walls). Countries may also choose development and risk reduction options that can be adjusted over time.

Specific adaptation strategies may also aim to build individual and institutional capacity. Countries may decide to strengthen their early warning system, or develop crop germplasm banks, and build related technical capacity. Adaptation measures may include risk insurance schemes for risk transfer and risk sharing, for example disaster insurance, including social insurance, which allows access to financial and other resources in times of disaster.

Table 2.5 gives examples of adaptation strategies and actions in the agricultural sector that reflect the planning horizon as well as the relevance of the measures for current and future risks.

TABLE 2.5. Adaptation pathway and adaptation options for the agriculture sector that reflect levels of regret and planning horizon: some examples for disaster risk reduction (DRR) and climate change adaptation (CCA).

	ACTION →				
	Choice of crop to meet immediate food security needs	**Whole farm planning and management**	**Identifying drought- and salt-tolerant crops**	**Drainage infra-structure**	**Community relocation**
DRR and CCA focus	Food security needs as a determinant of vulnerability	Current weather-related disaster risks	Current and projected climate risks	Economic well-being and projected climate risks	Projected climate risks
Relevance of option today vs relevance in the future	High	High	High	High-medium high (if increased standard)	Low
Planning horizon (years)	Now	5 years	10–20 years	30 years	50 years (may be less depending on the nature of hazard)

Source: PACC food security projects in the Solomon Islands, Fiji and Palau

Step 4.3. Prioritise and select adaptation measures

Governments often have to decide between investments to address current development issues, including disaster risks, while also preparing for uncertain longer term climate scenarios. There is no single approach or set of criteria that countries can use in assessing and prioritising adaptation measures, however a common form of analysis used to inform choice of options, particularly at the individual intervention level, is economic cost–benefit analysis. Cost–benefit analysis is useful to help systematically identify and explicitly consider all the factors informing a decision. Another analysis often used to compare adaptation options is the sustainable livelihood approach (SLA). In SLA, the focus is on analysing and integrating climate change adaptation based on sustainable livelihoods.

The OECD (2009) recommends considering the following when selecting adaptation options:

- Effectiveness – this addresses the extent to which an adaptation measure reduces vulnerability and provides other benefits. It includes the concept of flexibility, where a strategy can be adjusted in response to changing conditions;

- Cost – this concerns the relative costs of the different adaptation strategies, including the initial costs of implementation, operation and maintenance, administration and personnel under each strategy;
- Feasibility – this addresses the practicalities of implementation, such as whether the necessary financial, technical, human, and other resources are available;
- Social acceptance – the degree to which an adaptation strategy is acceptable by communities.

Multi-criteria analysis can also be used to inform choices, in addition to cost–benefit analysis. Multi-criteria analysis involves stakeholders expressing their preferences by scoring different choices against the set of agreed criteria. These scores are then aggregated across the groups to decide on the preferred option. Box 2.12 describes the multi-criteria approach used by Nauru to prioritise which sectors to target in response to current and projected climate risks.

BOX 2.12. MAKING CHOICES USING MULTI-CRITERIA ANALYSIS IN NAURU

Nauru undertook multi-criteria analysis to select priority sectors. The stakeholders first selected criteria that reflected their own areas of interests, using NAPA guidelines. These are summarised in Box 2.9.

The stakeholder groups then ranked (1–6) and scored (out of 100) their preferences for each sector based on their own assessment against the agreed criteria.

		VULNERABLE SECTORS					
GROUP		Fisheries and marine resources	Water resources	Agriculture	Human health	Disaster management	Coastal zones
One	Ranking	2	6	5	3	1	4
	Rating	11	21	40	18	5	5
Two	Ranking	5	6	4	3	2	1
	Rating	20	35	17	14	8	6
Three	Ranking	4	5	2	6	1	3
	Rating	16.5	22	10.5	32	8	10
Four	Ranking	5	6	3	4	1	2
	Rating	20	25	15	20	8	12
National	Ranking	4	1	3	2	6	5
	Rating	67.5	103	82.5	84	29	33

Source: Nauru Department of Commerce, Industry and Environment (2012 draft) and stakeholder workshop raw data (personal communication Mavis Depaune, Nauru PACC Project Coordinator, May 2012).

Phase 5 – Design of the strategic output

PURPOSE: Produce a strategic level document that clearly articulates the country's policy and/or plan of action.

PHASE 5 STEPS	EXPECTED OUTPUTS
5.1a 'Climate-proof' an existing strategic document: revise existing strategic document based on the results of Phases 2, 3 and 4 5.1b Develop a national climate change policy or other strategic climate change document: design from scratch the strategic document using the results of Phases 2, 3 and 4 5.2 Develop an implementation strategy, including governance arrangement, financing strategy and monitoring and evaluation (M&E) strategy	• 'Climate-proofed' strategic document (NSDS, sectoral plan/programme of work, policy, and/or corporate plans) • A clearly designed strategic document that shows vertical linkages across NSDS, climate change policy, national action plan, and sectoral programme of work, and/or corporate plans • Document with clearly articulated implementation strategy

This phase produces a design document ready for implementation. A strategic planning document normally covers a standard set of topics that includes vision, goals, objectives, outcomes, and monitoring and reporting indicators. It also includes an implementation strategy, and overall governance arrangements for implementation, and sometimes an indicative budget. The detailed content of the document will depend on the nature of the strategic instrument – that is, whether the instrument is to lay down the policy, to spell out the broad national strategies, or sector-specific strategies. Depending on the starting point, the design document will also explicitly demonstrate upward and downward vertical linkages showing relationships across the NSDS, climate change policy, national action plan, sectoral programme of work, and corporate plans. In national to corporate level strategic documents, the level of specificity about the subject matter and detail solutions will increase.

In this design phase, the steps will depend on whether a strategic-level instrument already exists, or whether one needs to be developed.

Step 5.1a. Climate-proof an existing strategic instrument

NATIONAL-LEVEL CLIMATE PROOFING

Where a national strategic instrument already exists, government and stakeholders may decide that the most cost-effective approach is to revise it using a climate change lens. This approach was used in Vanuatu for its Priority Action Agenda, as summarised in Box 2.13.

BOX 2.13. INTEGRATING DISASTER RISK MANAGEMENT (DRM) AND DISASTER MANAGEMENT (DM) INTO VANUATU'S PRIORITY ACTION AGENDA (PAA)

As Vanuatu's PAA, 2006–2015, had recently been approved, rather than start again to incorporate disaster risks it was decided to review it using a DRM lens to identify gaps. A joint national development partners' team developed a supplementary PAA, simultaneously with the National Action Plan for DRR and DM.

Changes included:

- Rephrasing the National Vision from *"An Educated, Healthy and Wealthy Vanuatu"* to *"An Educated, Safe, Healthy and Wealthy Vanuatu"*.
- Adding an additional national priority goal, called Safe, Secure and Resilient Vanuatu. Under this priority, eight specific objectives were identified:
  - Recognise DRM as a development issue and mainstream all-hazards risk management into all sectors and decision-making processes at all levels of government;
  - Recognise DRM as a development whole-of-country responsibility and actively engage communities, NGOs and the private sector in disaster risk reduction and disaster management;
  - Ensure a strong governance framework for DRR and DM, with clear policies and legislation, accountable institutional arrangements, across government, sectors and communities;
  - Ensure adequate resources and coordination mechanisms are devoted to DRR and DM;
  - Integrate DRR concerns into policies, plans and programmes of all levels of government in order to assist communities to reduce their risks and vulnerability to disasters;
  - Recognise that DRM is about supporting communities to reduce and manage risks, and empower communities by providing appropriate and timely information; building their capacity to make informed decisions; and promoting community-based DRM through participatory planning and public-private sector partnerships;
  - Promote knowledge-based decision-making, including traditional knowledge about disaster risk reduction and coping mechanisms in times of disasters;
  - Provide support for regional organisations and development partners.

Sources: Government of Vanuatu (2006a,b).

Kosrae, Federated States of Micronesia, adopted a similar approach in its PACC project, when it reviewed its State Code with reference to the national climate change policy. This experience is described in Box 2.14.

BOX 2.14. CLIMATE PROOFING OF EXISTING LEGISLATION IN KOSRAE, FSM

In 2011, the FSM Government approved changes to the Kosrae State Code to "recognise and define climate change and climate change adaptation measures and to require development activities in Kosrae to take account of projected climate changes, and to require the design and implementation of public infrastructure such as roads and buildings to incorporate climate change adaptation measures consistent with the requirements of the FSM National Climate Change Policy, 2009."

The amendments were identified as part of a mainstreaming exercise carried out under the PACC FSM project. Stakeholder consultations revealed that, although the FSM Climate Change Policy was endorsed in 2009, it had not been operationalised. The PACC Steering Committee decided that a statute was needed to give effect to the Policy, together with the need for a Climate Change Management Plan. The Department of Environment, with the help of the Steering Committee, identified key areas of the Kosrae State Code that needed amending to reflect climate change issues of concern: sea level rise, flooding due to intensive rainfall, storm surges, and gaps in governance systems.

A draft Bill was reviewed by the Steering Committee before submission to the Government. The Bill was passed by the 10th Kosrae State legislature, as State Legislation, 10-2- Kosrae Act, 2011. Some changes made to the Kosrae State Code are, for example:

- Inclusion of a new clause under S5.202: establishing Department of Transport and Infrastructure, and its role, including d), ... *public projects, with all location, design and construction to include and incorporate considerations of weather and climate extremes and climate change adaptation measures; ....*
- Amend Title 7. 405 to read: *Environment Impact Studies: The Authority requires ...an environment impact assessment study which shall include consideration of the effects of climate change and potential adaptation options in accordance with regulations established by the Authority.*

This exercise may be repeated by the other three states of the Federated States of Micronesia.

Source: Based on Kosrae State Government (2011) and the completed Mainstreaming Country Template by the PACC Coordinator, August 2012.

To 'climate-proof' existing national policies and strategies in instruments such as the NSDS, they should be reviewed with a 'climate lens' to assess if climate risk is already factored in. If not, then parts of the national policy need to be changed to better reflect climate risks. This can be done using standard strategic environmental assessment (SEA), which is a tool used to integrate environmental considerations into policies, plans and programmes, and to evaluate the inter-linkages with economic and social considerations. SEA provides a two-way evaluation, looking at the impact of policies, plans and programmes on the environment as well as addressing the impact of environmental change on policies, plans and programmes. It thus offers a useful framework to effectively integrate climate change considerations into policy processes at the national, sectoral and even corporate level.

The principles and the standard steps followed in an EIA process combined with climate risk assessments could be used to guide climate proofing of policies and strategies. Standard Phases 1–3 would be completed. Phase 4 (identification of adaptation options) would involve reviewing the existing strategic instrument using a climate risk lens.

Information collected during Phases 2–4 to questions such as the following can help in revising the strategic instrument:

- Which climate change factors are likely to be of concern?
- What impacts associated with these factors have been observed, and what are the drivers?
- What are the impacts under projected climate and socio-economic conditions?
- Which development priorities, geographical areas, and sectors are likely to be affected?
- Has climate change been considered in the national policies, plans and programmes of interest?
- What changes in policies, strategies and programmes need to be made to reflect climate risks?

SECTORAL-LEVEL CLIMATE PROOFING

The steps followed in climate proofing national policies, plans and strategies can also be implemented at the sectoral level, asking more sector-focused questions. Questions include:

- Which sectoral development priorities, geographical areas, and strategies are likely to be affected by climate factors?
- Have weather and climate change risks been considered in the current sectoral policies, strategies and programmes? If not, then what changes need to be made? (These will be identified on the basis of problem-solution analysis carried out in Phases 3 and 4, drawing on scientific knowledge about underlying biophysical processes, weather and climate events, and ecological and economic systems, as well as about socio- and economic linkages. Sector specialists will particularly have a critical role to play in this step.)
- If there is a national climate change policy and strategic action plan, are these reflected in the sectoral plan; and are the sectoral policies, plans and programmes fully aligned with them?

Box 2.15 gives an example of the process used in Fiji for climate-proofing sectoral plans.

BOX 2.15. KEY STEPS IN CLIMATE PROOFING OF SECTOR LEVEL PLANS AND PROGRAMMES AND ALIGNING WITH THE NATIONAL CLIMATE CHANGE POLICY (FIJI)

Under the German Government-funded project, 'Coping with Climate Change in the Pacific Islands Region' (CCPIR), the Fiji Government developed its National Climate Change Adaptation Strategy (NCCAS) for land-based resources. Technical support was provided by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). Key steps included:

- Documenting recent and anticipated changes in Fiji's climate;
- Identifying current and anticipated risks, vulnerabilities and adaptive capacity with reference to land-based resources;
- Reviewing current adaptation efforts – projects and programmes;
- Identifying specific adaptation measures to address strategic gaps for each land-based sector. This was referenced to Fiji's national Climate Change Policy for agriculture, forestry, water, biodiversity and environment, and land.

Source: Government of Fiji (2012a)

COMMUNITY-LEVEL CLIMATE PROOFING

A community-based strategic instrument focuses on local issues whose geographical boundary are defined by social and ecological processes as well as the local sphere of governance influence. To climate proof a local instrument, one would assess if climate risk is factored into the local priorities and strategies. If not, the plan needs to be changed to reflect current and projected climate risks, based on the detailed context-specific technical analysis that was carried out during Phases 2, 3 and 4.

Attention should also be given to how the community-based plan will be operationalised, by whom, and how it will be tracked over time. Such strategic documents should therefore include an implementation strategy including the agreed governance approach and a monitoring, evaluation and reporting strategy.

Step 5.1b. Develop a national level climate change policy and/or strategic action plan

A new strategic instrument is developed using the information generated in Phases 1, 2, 3 and 4. The lead agency and/or steering group synthesises the climate change risk and risk management information. They identify specific thematic goals, and associated with each goal the expected outcome(s). To achieve each outcome,

stakeholders identify specific strategies and detailed actions/activities under each strategy. Such activities and strategies may be specific to one agency or may require collaboration between several agencies, and this should also be specified.

Information about the goals, strategies, actions, lead agency and partners are compiled into a single document using a logical framework. The instrument reflects the hazards, risks, and determinants of risks, respective response measures, thematic goals and objectives, strategies and expected outcomes.

Box 2.16 gives an extract from Tuvalu's National Strategic Action Plan, and its link to the National Climate Change Policy. It also illustrates the link between national policy goals, strategies and actions, and how policy goals and outcome are further unpacked to identify key actions, lead government agencies and relevant development partners.

BOX 2.16. EXTRACT FROM TUVALU'S NATIONAL STRATEGIC ACTION PLAN

GOAL 1 – Strengthen adaptation actions to address current and future vulnerabilities			
Strategies	**Actions**	**Lead agency**	**Partners**
1.3 Integrated and coordinated water resources (including desalination) planning and management including preparedness and response plans for each island	1.3.1 Assess water availability and feasibility of water security options including rainwater harvesting, underground water and desalination on all islands	Ministry of Communication Transport and Public Utilities (MCTPU), Ministry of Foreign Affairs, Trade, Tourism, Environment and Labour (MFATEL)	Office of the Prime Minister (OPM)
	1.3.2 Implement improved rainwater harvesting, access to underground water and install energy efficient desalination on all islands	MFATEL, Ministry of Public Utilities (MPU), Ministry of Health (MOH)	OPM
	1.3.3 Prepare awareness materials on water conservation and safety		
	1.3.4 Implementation consistent with National Water Policy, Integrated Water Resource Management (IWRM) Plan and other water-related plans, Public Health Act (Water Sector) and recommendations from previous studies	MOH, Ministry of Home Affairs and Rural Development (MHARD)	MFATEL, OPM
	1.3.5 Develop drinking water safety components for the Island Strategic Plans (ISPs)	MCTPU, MOH	
	1.3.6 Develop a national IWRM Plan	As above	
GOAL 2 – Improve understanding and application of climate change data, information and site-specific impacts assessment to inform adaptation and disaster risk reduction programmes			
2.1 Upgrade capacity of the National Meteorology Services including stations on the outer islands	2.1.2 Develop protocols for sharing weather and climate data 2.1.6 Develop weather and climate products for the agriculture and fisheries sectors, tourist operators, women and men 2.1.7 Develop and conduct relevant public awareness of weather and climate information	MCTPU	MFATEL, OPM

Source: Government of Tuvalu (2012a, b)

BOX 2.17. EXTRACT FROM FIJI'S CLIMATE CHANGE POLICY, SHOWING THE TYPES OF INFORMATION THAT MAY BE CONTAINED IN AN IMPLEMENTATION PLAN.

	STRATEGIES	TIMEFRAME					Lead agency	Implementing agency
		2012	2013	2014	2015	2016		
	Objective 1: Mainstreaming							
1	Incorporate climate change into National Plans and budgets in line with the Climate Change Policy Implementation Framework.	■					Ministry of Planning	Line ministries
2	Ensure that reviews of national and sectoral policies align with the Climate Change Policy.	■	■	■	■	■	Climate Change Unit	Line ministries, Solicitor General's Office
3	Consider the Climate Change Policy in legislative review processes and develop cooperative and coordinated agreements between sectors to ensure enforcement.	■	■	■	■	■	Solicitor General's Office	Solicitor General's Office, all government agencies
4	Consider lessons learnt and recommendations of national and local-level reports, projects and studies relating to climate change in the national, divisional and local planning processes.	■	■	■	■	■	Climate Change Unit	Line ministries, provincial councils, local governments, municipal councils
5	Consider climate change implications in all strategic national development planning, including land use planning, development assessment, infrastructure and settlement planning.	■	■	■	■	■	Ministry of National Planning	Climate Change Unit, Departments of Agriculture, Forestry, Fisheries, Infrastructure, Tourism, Health, Housing, Urban Development
6	Ensure all sectors coordinate climate change adaptation and disaster risk reduction efforts to enhance aid effectiveness and streamline implementation.	■	■	■	■		Ministry of Planning	Line ministries, Climate Change Unit
7	Climate Change Unit to facilitate the design and implementation of a National Monitoring and Evaluation tool to assess and improve on climate change integration in sectors, including enforcement of climate change related legislation.	■	■	■	■	■	Climate Change Unit	Ministry of National Planning
8	Include climate change programs in the responsibilities of the Environment Management Unit within all Departments.	■	■	■	■	■	Climate Change Unit	Ministry of National Planning, provincial councils, line ministries
9	Review public health and social policies to ensure consideration of climate change impact projections and appropriate mitigation and adaptation measures.	■	■	■	■	■	Ministry of National Planning	Climate Change Unit, Ministry of Health, Social Welfare,
10	Review the national building code to ensure consideration of climate change impact projections and appropriate climate change resilience measures.	■	■	■	■		Climate Change Unit	Local Government, Urban development, Tourism, Housing

Source: Government of Fiji (2012b): table 9

Step 5.2. Develop an implementation strategy

Pacific island countries and territories have used many different approaches to their climate change related strategic implementation planning. Ideally, a strategic policy document will include an implementation plan with key strategies under each objective, a clearly identified lead agency to coordinate the implementation plus executing partner agencies, and a timeline. Box 2.17 shows an implementation plan for the Fiji Climate Change Policy, with such features. Sometimes the implementation plan provides only policy directives for government agencies and other stakeholders to then follow up on. This was done in the Solomon Islands as described in Box 2.18. Regardless of the approach, a strategic plan of implementation must clearly articulate a governance arrangement, as well as a monitoring and evaluation strategy and financing strategy.

BOX 2.18. GOVERNMENT DIRECTIVE FOR POLICY IMPLEMENTATION IN THE NATIONAL CLIMATE CHANGE POLICY INSTRUMENT (SOLOMON ISLANDS)

POLICY DIRECTIVE AND STRATEGIES: The government shall work together with stakeholders and development partners to strengthen the capacity of national, provincial and community organisations and human resources for the effective planning and implementation of appropriate climate change adaptation, disaster risk reduction and mitigation actions.

Accordingly, the government shall:

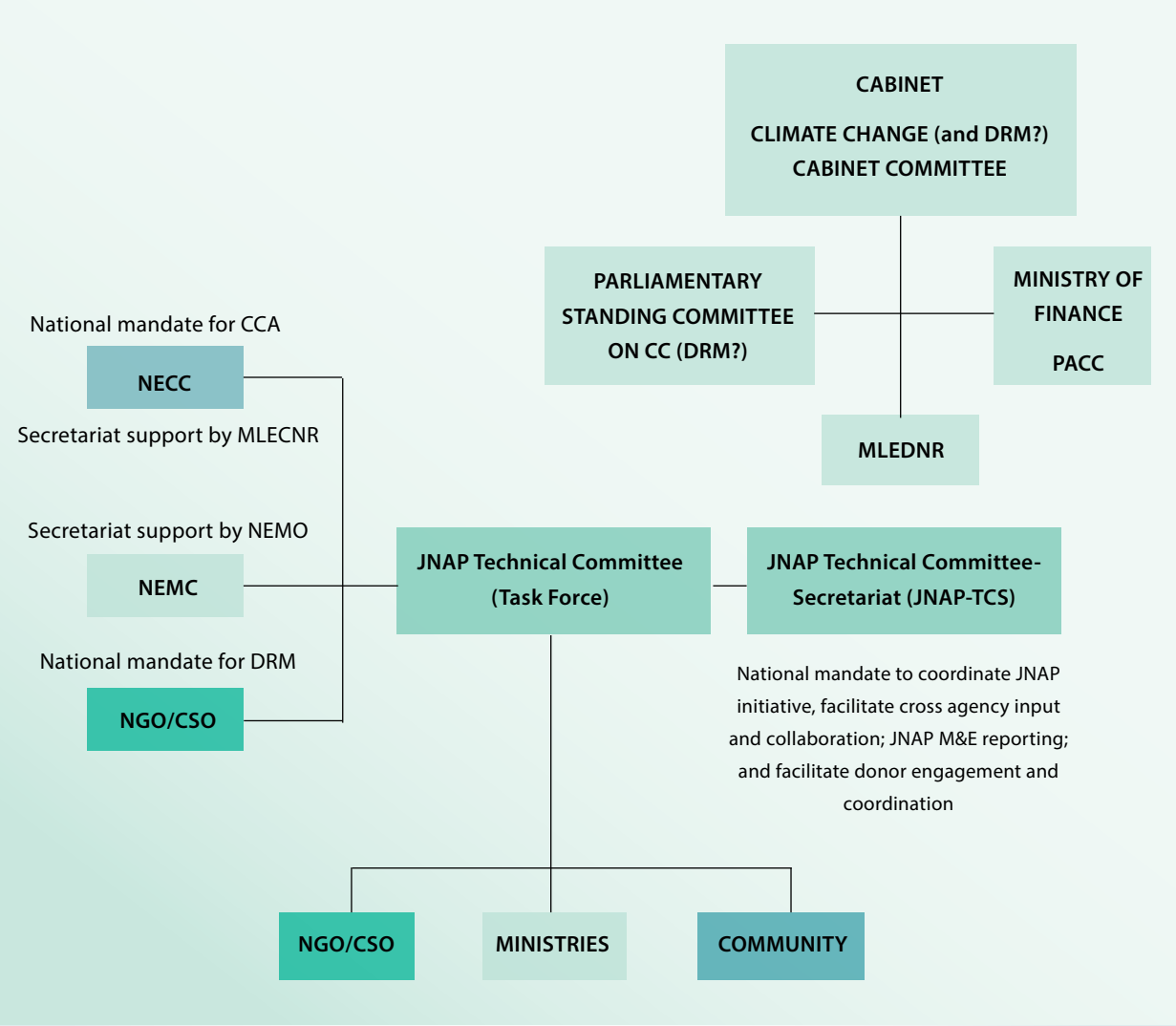
- Support agencies and partners to develop and implement climate change communication strategies to ensure that clear messages about climate change are produced and disseminated;
- Integrate climate change into the national primary, secondary and tertiary and non-formal curricula;
- Assess capacity needs from time to time and identify and prioritise human resources development needs and train specialised experts through targeted scholarships and training activities;
- Design and deliver training packages aimed at raising people's understanding of climate change and enhance knowledge and skills to plan and implement adaptation, DRR and mitigation actions;
- Strengthen data and information management systems and protocols to enable effective dissemination and sharing of information.

Source: Government of Solomon Islands (2012)

GOVERNANCE ARRANGEMENT

For a cross-cutting issue such as climate change, it is critical for national and sectoral strategic instruments to have a clear governance arrangement across key government agencies. Each country should decide on its own governance arrangement, depending on existing national government structures, which ministry is responsible for climate change management and DRM, and whether climate change and DRM are seen as being closely related. In Tonga, for example, the recognition of the close relationship between climate change and DRM led to the first Joint National Action Plan in the Pacific, and formation of a JNAP Secretariat (Box 2.19). Other governance arrangements in the region include a joint coordinating committee such as in Fiji and the Cook Islands.

BOX 2.19. GOVERNANCE ARRANGEMENT FOR THE IMPLEMENTATION OF THE JNAP IN TONGA



Source: Government of Tonga (2010)

MONITORING AND EVALUATION (M&E) STRATEGY

A policy instrument normally states how its effectiveness will be monitored, evaluated and reported back to the government. M&E is carried out to make changes in line with national needs and climate risks as new information becomes available. Each strategic action plan document should contain indicators to report back on performance against objectives and the country's development goals. No single type of M&E system would work for all types of interventions. Ideally, an M&E system tracks outcomes over time. The choice of indicators will also depend on which adaption pathway was selected, and specific development outcomes against which reporting will occur. For example, different types of indicators would be used where the outcomes relate to:

- Strengthening adaptive capacity – by increasing assets (human, social, financial, physical, and natural) and institutional function (policies, early warning system);
- Reducing specific climate hazards – by adopting 'no-regrets' adaptation measures to improve resource and environment management that helps reduce the chances of flooding;
- Reducing specific vulnerability and drivers of vulnerability – by improving livelihoods and environmental management.

UNDP-GEF suggests four categories of indicators to use when monitoring climate change adaptation at the strategic level (Table 2.6).

TABLE 2.6. Indicators that can be used for monitoring and evaluating at strategic levels.

Coverage – Number of:

- Policies, plans or programmes introduced or adjusted to incorporate climate change risks
- Stakeholders (communities, households, agencies, decision-makers) engaged in capacity building activities for vulnerability reduction or improved adaptive capacity
- Stakeholders served by new or expanded climate information management systems (early warning systems, forecasting, etc.)
- Investment decisions revised or made to incorporate climate change risks
- Risk-reducing practices/measures implemented to support adaptation of livelihoods and/or resource management

Impact – Percentage change in:

- Stakeholders' behaviours using adjusted processes, practices or methods for managing climate change risks, assessed via questionnaire-based surveys or other evidence
- Stakeholders' capacities to manage climate change (such as communicating climate change risks, disseminating information, or making decisions based on high quality information), as relevant, assessed via questionnaires
- Use of information management systems (such as early warning response times)
- Stakeholder perceptions of vulnerability (or adaptive capacity) to a recurrence of primary climate change-related stress(es), assessed via questionnaire-based surveys
- Availability of narrative description of the role of project interventions in reducing vulnerability (or improving capacity to adapt to climate change-related threat(s)), assessed via questionnaire-based surveys
- Relevant quantitative development outcome (food security, water resources, health outcomes, etc.) as supplemental indicators

Sustainability

- Number of stakeholders involved in capacity building for implementing specific adaptation measures, policy/planning processes or decision-support tools
- Availability of skills and resources necessary to continue adaptation after conclusion of project (at relevant scale), assessed via questionnaire-based surveys
- Stakeholder perceptions of adaptation sustainability, assessed via questionnaire-based surveys

Replication

- Number of 'lessons learnt'
- Number of relevant networks or communities with which lessons learnt are disseminated

Source: UNDP (2008)

FINANCING STRATEGIES

Countries usually also include a financing strategy as a component of their implementation strategy. To be able to operationalise policy instruments, countries have attempted to cost them, particularly if they have also developed a detailed plan of action. Having a costed plan of implementation helps a country to better engage with development partners for programmatic support. Some countries have identified alternative pathways for sourcing financial resources. Samoa and the Cook Islands, for example, applied to become national implementing entities (NIE) under the Climate Change Adaptation Fund. In another approach, Tonga established a National Climate Change Trust Fund with the support of ADB.

Phase 6 – Implementation, monitoring and evaluation (M&E)

PURPOSE: Implement, monitor, evaluate and report on progress against the stated objectives of the policy and plan of action and with respect to the country's development goals.

PHASE 6 STEPS	EXPECTED OUTPUTS
6.1 Implementation • Confirm sector/cross-sectoral programme of actions identified in Phase 5 • Identify appropriately sequenced set of activities to be implemented, including lead agencies and collaborating partners • Secure funding	• Linked NSDS, climate change policy, national action plan, and or sectoral programme of work
6.2 Monitoring and evaluation, and reporting	• Regular M&E reports across different stakeholders and all levels of government, reflecting vertical relationship between project, programme, sector, climate change policy goals, objectives and strategies and NSDS

Step 6.1. Implementation

Before strategies are implemented, the programme of work needs to be defined across sectors and agencies, and resources secured. In Phase 5, stakeholders will have identified a suite of actions required to produce the desired outcomes. In Step 6.1, agencies will decide on things such as the relevant sequence of activities to be implemented in order to facilitate synergistic outcomes. Collaboration and lead agencies will also be further refined and resources secured. Implementation of a national-level instrument needs to be carefully supported, using national and development partner resources.

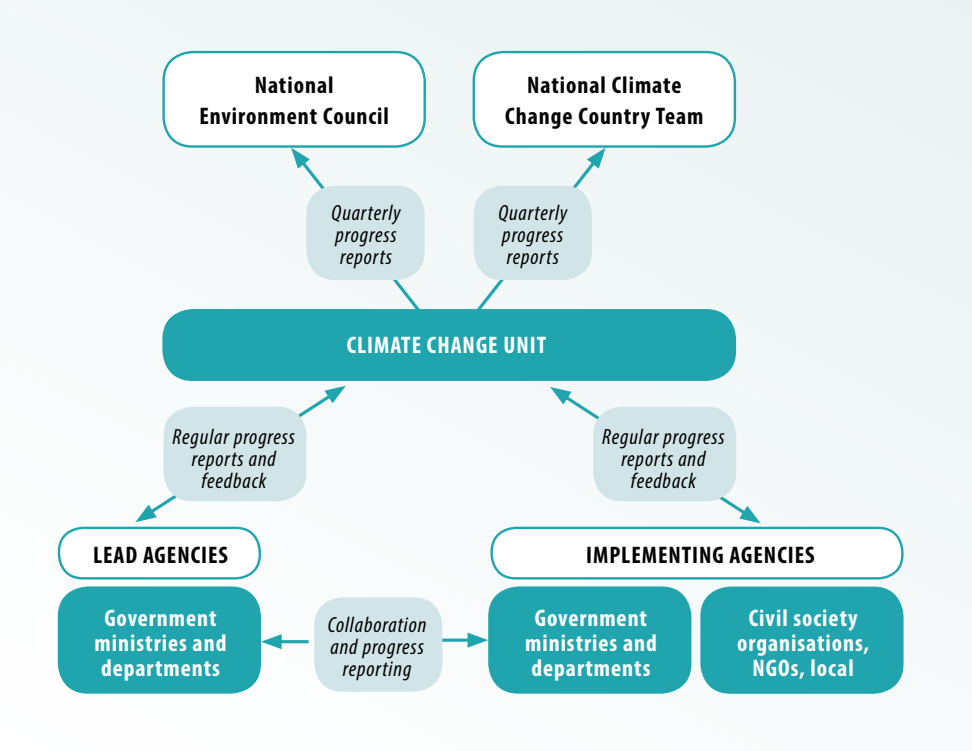
Step 6.2. Monitoring, evaluation and reporting

Monitoring, evaluating and reporting are key to any strategic instrument. Whether such an instrument provides strategic direction at the national, sectoral and/or community levels, M&E and reporting help governments, stakeholders and partners to track progress against the stated goals and objectives, as well as learn what works and what changes need to be made to better adapt in a changing climate.

Governments need to establish appropriate reporting mechanisms, identifying the reporting chain, frequency of reporting (e.g. 6-monthly, annually) and by whom, the format of reports, and appropriate databases. The process could be linked to the regular national development reporting against the NSDS and other commitments.

Box 2.20 summarises the channel of reporting on the progress of Fiji's National Climate Change Policy, which is done on a quarterly basis.

BOX 2.20. HIERARCHICAL REPORTING OF PROGRESS AGAINST THE NATIONAL CLIMATE CHANGE POLICY (FIJI)



Box 2.21 shows how Solomon Islands has approached the different levels and types of reporting on the progress of the implementation of their climate change policy.

BOX 2.21. M&E STRATEGY FOR THE SOLOMON ISLANDS NATIONAL CLIMATE CHANGE POLICY

Monitoring this Climate Change Policy will be done annually at the following levels:

- Political – by the Parliamentary Standing Committee;
- Policy – by the National Climate Change Council and Provincial Climate Change Coordination bodies;
- Programme and project – by the national lead agency for climate change and the Climate Change Working Group.

Source: Government of Solomon Islands (2012a)

Capacity development may be needed to undertake effective M&E and report writing. Box 2.22 gives an example of the kinds of capacity development and other issues that the Solomon Islands identified in relation to M&E of their climate change policy.

BOX 2.22. MONITORING AND EVALUATING EFFECTIVENESS OF THE SOLOMON ISLANDS NATIONAL CLIMATE CHANGE POLICY

The Solomon Islands Climate Change Policy identifies the approach the Government intends to undertake for M&E and reporting on the Policy.

It notes: The government shall establish a mechanism to monitor the implementation of this climate change policy. To ensure this is achieved, the government shall:

- Ensure all government agencies, NGOs, churches, institutions and private sector organisations and communities that implement climate change-related programmes and projects, are required to register with the national lead agency for climate change and provide annual reports for purposes of monitoring.
- Strengthen the capacity of the lead agency for climate change to undertake the following monitoring and evaluation activities:
  - Establish a database of all actors involved in climate change programmes and projects and disseminate information on climate change programmes and projects;
  - Produce and disseminate an annual report on progress in addressing climate change;
  - Communicate regularly with partners to obtain information on progress of implementation of the climate change policy and strategies;
  - Develop the National Communications to the UNFCCC.
- Support national and provincial government agencies, and civil society actors, strengthen capacity for monitoring the implementation of this policy through existing mechanisms such as sectoral committees, and national councils.
- Evaluate the implementation of this policy every five years to gauge the effectiveness and efficiency of implementation of strategies against the policy goal, objectives, directives and strategies.
- Building on the reporting process of projects, assessments and surveys, develop and build capacity for a community feedback mechanism where experiences and lessons learnt at the community level feed back into the policy implementation process.

Source: Government of Solomon Islands (2012a)

A toolkit recently developed by the UK Government, AdaptMe, may help with thinking through key issues for M&E and designing a robust evaluation process (www.ukcip.org.uk/adaptme-toolkit/).

Phase 7 – Review and adjust

PURPOSE: Update key strategic instruments with lessons learned and new information on future climate.

Phase 7 involves the review of the effectiveness and efficiency of adopted adaptation measures, identification of key lessons, and making adjustments or changes to adaptation responses. This may involve making changes at the level of overarching policies, goals, strategies and programmes of adaptation measures, with respective changes in the outputs.

PHASE 7 STEPS	EXPECTED OUTPUTS
7. 1 Review and adjust or change adaptation pathway and specific instruments	• Adjustments in strategic level instrument as relevant • Revised strategies and plans of actions at the national and associated provincial/area action plans, sectoral plans of action, and corporate plans etc.

The M&E reports prepared in Phase 6 will be reviewed against key impacts and indicators, together with any new climate change information. The review will help decide if adaptation strategies and responses need to be adjusted or changed. At a minimum, the review will take place when the strategic instrument comes up for review, preferably aligned with the review of the NSDS.

PART 3

ON-THE-GROUND MAINSTREAMING

PART 3. ON-THE-GROUND MAINSTREAMING

3.1. Introduction

Climate change affects all areas of development, and therefore climate risk considerations need to be incorporated into all types of on-the-ground initiatives. Climate risk needs to be a major consideration throughout all stages of project planning and implementation, and across all sectors and all types of projects. These include projects concerned with, for example, water security, energy, food security, and infrastructure, sectors that are highly sensitive to climate change. However, even projects in seemingly climate-unrelated areas should not ignore climate.

Mainstreaming on the ground can be done in different ways. Ideally, new initiatives will align with directions articulated in relevant strategic level instruments. In some instances, for example in Nauru under the PACC project, strategic level instruments and the on-the-ground initiative were developed simultaneously.

Projects may be designed to specifically address the climate risk, and the project goals will include climate risk reduction, reflected in reduced vulnerability or increased resilience to climate impacts. These include projects which directly tackle increased risks due to climate change, such as the coastal zone management project in the Cook Islands, or climate proofing of road infrastructure in the Solomon Islands (see case studies below). Other projects may directly address climate risks without having explicit climate goals. These include 'no regrets' projects, which have primarily economic and/or social development goals but also contribute to reducing vulnerability under many different climate scenarios. The Nauru PACC project is an example, aiming to improve water security (with associated sanitation and health benefits) and thereby also reducing vulnerability to the climate risks related to drought. Natural resource management initiatives also fall into this category, for example by improving food and income security, or improving ecosystem services that reduce climate-related hazards such as flooding. The Solomon Islands PACC project is an example.

Other projects may have goals that appear to be unrelated to climate, but have important implications for climate change impacts. For example, some economic development projects, such as coastal development and mining, may have direct or indirect environmental impacts and may affect sustainability of other initiatives under changed climatic conditions. In such cases it is important that climate risk considerations are integrated into the project development process. Where an on-the-ground initiative has already been designed or implemented, climate risk considerations may be 'added on', for example infrastructure may be retrospectively climate proofed.

The framework described in Part 1 of this Guide can be applied to on-the-ground initiatives and adapted to local contexts. Figure 3.1 depicts the seven-phase decision-making cycle and the technical steps from climate risk management, adapted for the project level. Table 3.1 details the steps , technical assessments and expected outputs for each of the project phases. These closely align with the strategic level process, and much of the rationale in Part 2 also applies to project level mainstreaming.

FIGURE 3.1. Mainstreaming at the project level: the standard project cycle and CRM technical inputs.

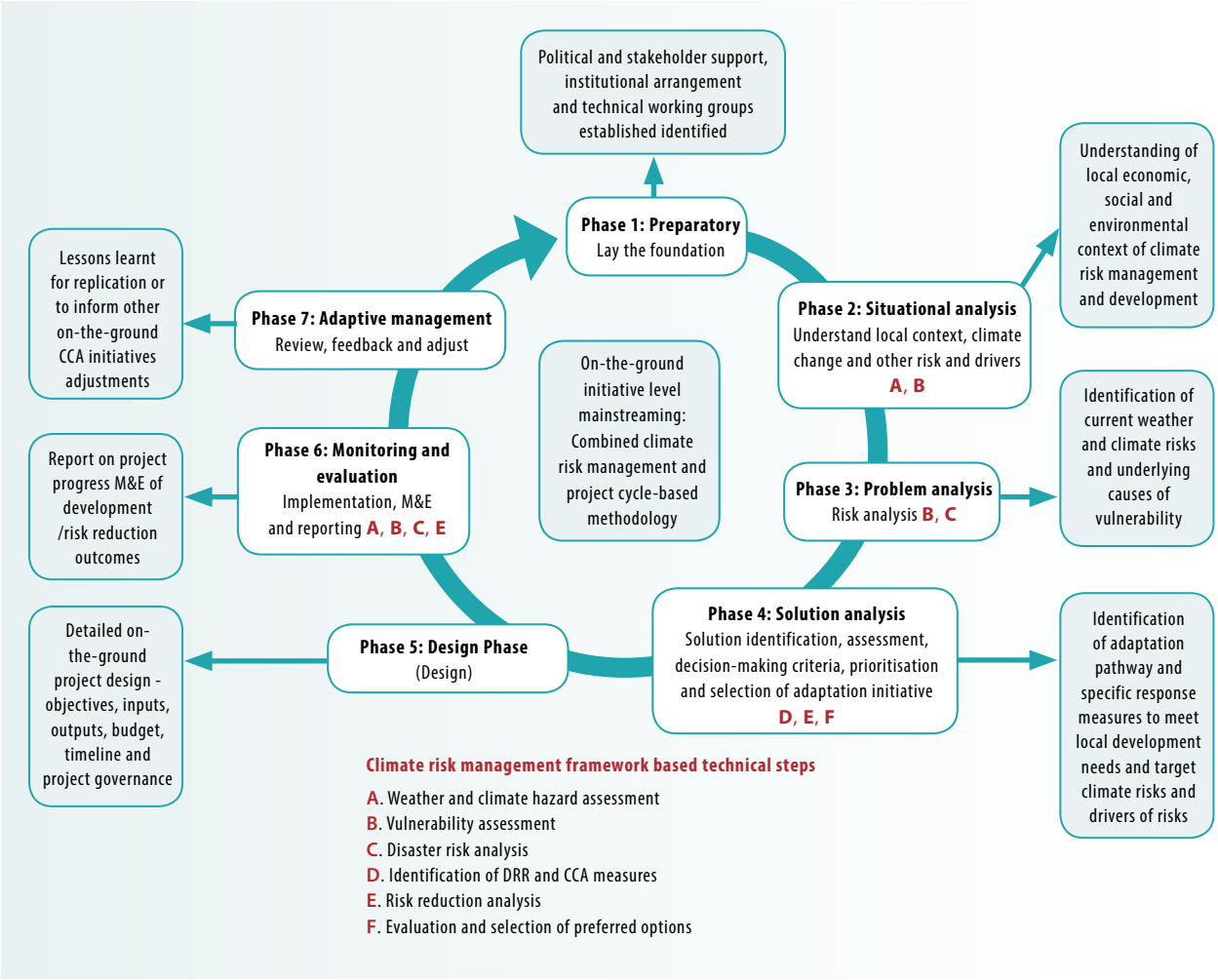


TABLE 3.1. The seven phases of the project cycle, with key technical assessments and expected outputs during mainstreaming

	KEY STEPS AND TECHNICAL ASSESSMENTS	EXPECTED OUTPUTS
Phase 1 – Preparatory Purpose: Establish the political, organisation and technical foundation required to support the mainstreaming exercise	1.1 Raise awareness 1.2 Establish stakeholder support, including political support 1.3 Establish appropriate stakeholder-based institutional arrangement for the mainstreaming exercise, including community engagement 1.4 Identify types of scientific information, analysis, and expert support that may be relevant, together with experiential knowledge	Improved understanding and secured political support Secured cross-agency and other stakeholders engagement and support Stakeholder-based institutional arrangement established to inform, guide and support key decisions, including community engagement Data sources and relevant technical and traditional experts identified
Phase 2 – Situation analysis Purpose: Understand the local development context, weather and climate risks, and vulnerable groups, including drivers of vulnerability	2.1 Understand the local community development context, their needs and aspirations, vulnerability and drivers of vulnerability 2.2 Understand current weather and climate conditions and their impacts and projected climate scenarios 2.3 Document current disaster risk management practices, including community experiences with climate hazards and experiential knowledge in coping with disasters Technical assessments: A, B	A status report on: • Local economic, social, and environmental context, together with local decision-making processes, institutional and political environment • Current weather and climate conditions and their impacts and projected scenarios • Community vulnerability, including drivers of vulnerability • Current disaster risk management, including community experiences with climate hazards and experiential knowledge in coping with disasters
Phase 3 – Problem analysis: current and projected risks Purpose: Assess risks under current and projected climate conditions, gaps in DRM, and root causes of vulnerability at the local level	3.1 Analyse current weather and climate risks, other drivers of risks, including root causes of vulnerability 3.2 Assess gaps in current disaster risk management at the local level; and in human development conditions that are drivers of their vulnerability 3.3 Assess projected weather and climate risks, and changes in other drivers of risks Technical assessments: B, C	A status report on: • Current weather and climate risks and other drivers of risk and root causes • Gaps in disaster risks management and development needs • Projected climate risks and vulnerability • Projected changes in causes of other risks • Priority sources of risks to target
Phase 4 – Solution analysis: risk reduction measures and prioritisation Purpose: Identify and select preferred adaptation responses to climate change risks	4.1 Identify decision-making criteria for selecting adaptation pathway for the community, that balances current development needs, current disaster risk management and projected climate risks 4.2 Identify adaptation (and/or climate compatible development) options for their priority hazards 4.3 Select priority adaptation option(s), based on cost–benefit analytical framework-based criteria, including quantitative and qualitative information Technical assessments: D, E, F	Results of problem-solution analysis discussed by stakeholders and key adaptation and development measures identified Relative benefits and costs of alternative adaptation options assessed Priority adaptation and development measures selected based on qualitative and quantitative assessment

TABLE 3.1. *Continued*

	KEY STEPS AND TECHNICAL ASSESSMENTS	EXPECTED OUTPUTS
Phase 5 – Project design Purpose: Produce a project design document that includes objectives, activities, inputs and outputs, budget, performance indicators and an M&E plan	5.1 Identify specific objectives and expected outcomes for the selected on-the-ground initiative 5.2 Identify activities/tasks, their respective methodologies, inputs, including data/ information needs and sources 5.3 Identify key collaborating agencies and partners and their respective roles 5.4 Prepare a budget, including resource allocation to other agencies as required 5.5 Identify realistic timeline and key milestones	Project design document that articulates: • Problem statement linked to climate policy goals and NSDS: Key development need/ climate risk challenge being addressed • Clearly articulated goal(s) and objectives of the initiative • Activities/ tasks and their respective methodologies, inputs required, including data/ information needs and sources, and technical expertise • Key collaborating agencies and partners • Expected outputs, timeline and key milestones • M&E indicators and reporting mechanism • Budget • (Log frame may also be included where appropriate)
Phase 6 – Implementation, monitoring and evaluation (M&E) Purpose: Implement, monitor and evaluate progress	6.1 Implement 6.2 Monitor, evaluate and report on the project and against national development goals	Regular M&E reports on the progress of the initiative against stated objectives and expected outputs Ex-post evaluation report on the delivery against stated objective and expected outcome linked to NSDS goals
Phase 7 – Review lessons learned to inform other projects Purpose: Review effectiveness of the on-the-ground initiative, identify lessons learned to inform adjustment to the project and/ or other initiatives	7.1 Review effectiveness and efficiency of initiative 7.2 Evaluate the outcomes, including ex-post CBA where appropriate 7.3 Identify and revise changes required in the light of new information and performance	A review report, including expost cost-benefit analysis and lessons learnt A decision to adjust/change current initiative design, and/or replicate if CBA indicates the benefits outweigh the costs

This part of the Guide uses five case studies to illustrate mainstreaming on the ground in the Pacific region. The case studies highlight key features that contributed to the projects' success in terms of integrating climate risks. Table 3.2 gives an overview of the five case studies and their key features.

TABLE 3.2. The five case studies, and their key features

CASE STUDY	KEY FEATURES CONTRIBUTING TO SUCCESSFUL MAINSTREAMING
Case study 1: Cook Islands PACC project	• Participation of local communities to identify climate-sensitive coastal issues of importance (Phase 1) • Identifying gaps in technical skills early in the process, and securing technical service providers (Phase 1) • Community members worked in partnership with scientists to calibrate scientific assessments with community's knowledge under problem and solution analysis (Phases 2, 3 and 4)
Case study 2: Nauru PACC project	• Establishment of a high-level steering group as well as a technical and inter-agency steering group to support the national and on-the-ground mainstreaming process (Phase 1) • Stakeholder-based processes for climate risk management decisions at national and sectoral levels, supported by sound technical information and advice • Use of multi-criteria analysis to make informed step-wise choices, recognising limited quantitative and qualitative information (Phase 4)
Case study 3: Taro leaf blight management in Samoa	• An adaptation measure that can also be regarded as a 'no-regrets' option as it addresses current needs, and is also an investment in institutional capacity to make informed adaptation choices with changing climate (Phase 4) • Use of knowledge about pests and diseases and crop science to inform the choice of the on-the-ground activity (Phases 2–4) • Selection of crop improvement-based adaptation pathway as a response to TLB and after traditional agrochemical-based approach proved unsuccessful (Phase 4) • Partnerships across countries, organisations and communities directly affected by climate risks (Phase 5) • Ex-post cost–benefit analysis to inform replication of the adaptation measure (Phase 7)
Case study 4: Solomon Islands PACC project	• Use of V&A assessment together with robust science to inform integrated climate risk management and decision-making (Phases 3 and 4) • Engagement of experts to inform problem-solution analysis and design of the initiative • Systematic analysis of adaptation options, including cost–benefit and feasibility analysis, to inform adaptation choice (Phase 4) and project design; even though the project started off as an adaptation initiative for climate change, the final choice of improvements in farm management practices was made to address current vulnerability given current resource constraints and feasibility issues
Case study 5: Climate proofing roads in Western Guadalcanal, Solomon Islands	• Climate proofing involved reconsideration of the project, essentially repeating the first five phases of the project cycle with a 'climate lens' • Additional climate risk assessment is required including additional field work and technical analysis, which are the same key technical components, A–F, of climate risk management (Phases 2–4) • CBA may need to be done in phases, initially identifying the broad strategies for climate proofing, followed by a detailed CBA of design of specific physical elements to withstand increased risks (Phase 4) • Need for ex-post climate proofing could be avoided if the existing EIA process in the country were implemented and projects assessed by also including climate risks considerations together with environment and other development criteria

3.2. Case studies

CASE STUDY 1 – The Cook Islands PACC project: integrating scientific knowledge and community experience

This case study analyses the Cook Islands PACC project, which is a coastal zone management project on Mangaia Island. The case study was developed from information contained in the UNDP and SPREP initial country consultation report (UNDP, 2006), SPREP's tender request document (SPREP, 2010), the SOPAC-NIWA proposal for Cook Islands PACC project (SOPAC and NIWA, 2010), the SPREP project summary reports prepared by NIWA (Stephens 2011; Stephens and Ramsay, 2012), follow-up discussion with Doug Ramsay, National Institute of Water and Atmospheric Research, New Zealand (NIWA), and discussions with Taito Nakalevu, PACC Regional Programme Manager.

The following features of the project are highlighted in this case study, under the relevant phases of the project cycle:

- Participation of local communities to identify climate-sensitive coastal issues of importance (Phase 1);
- Identifying of gaps in technical skills early in the process, and then securing technical service providers (Phase 1);
- Community members worked in partnership with scientists to calibrate scientific assessments with the community's knowledge under problem and solution analysis (Phases 2, 3 and 4); this included selecting criteria based on the community's own level of risk preference, their planning horizon, the functional life of their physical structures, and the projected coastal run-up (Phase 3); and selecting the preferred adaptation pathway and short, medium and long term strategies (Phases 3 and 4);
- The use of a combined 'impacts first' and 'vulnerability first' approach to climate risk assessment to support adaptation decisions.

Project background

A situation analysis, looking at the vulnerability of the Cook Islands to climate change, was carried out during the initial PACC project consultation (UNDP, 2006). The Cook Islands Government hoped to align the PACC project with an ongoing New Zealand-funded coastal project, and the original focus for the project was to be 'Climate Proofing of Manihiki Coastal Zone Management and Airport Redevelopment'. However the focus was changed to 'Climate Change Adaptation in the Coastal Zone of Mangaia' when the two projects at Manihiki could not be synchronised.[2]

Phase 1 – Preparatory

In Mangaia, an NZAID-funded project was underway on the rehabilitation of the Mangaia harbour, which the PACC project team aimed to build on or align with. Initial consultation with the Mangaia Island Council identified the need to also address the broader coastal zone issues on the island. Communities were particularly concerned about 'freak waves' that could move up to 50 metres inland during high tide, heavy swells and cyclonic conditions. The Cook Islands Ministry of Infrastructure and Planning (MOIP), the Mangaia Island Administrator and the Island Council confirmed the lack of local technical expertise to address such a phenomenon. This initial consultation thus defined the scope, scale and nature of the PACC project.

SPREP, as the PACC project executing agency in collaboration with the MOIP, called for tenders to document nearshore wave run-up, climate, bathymetry, coastal topography, shoreline positions, and coastal morphology

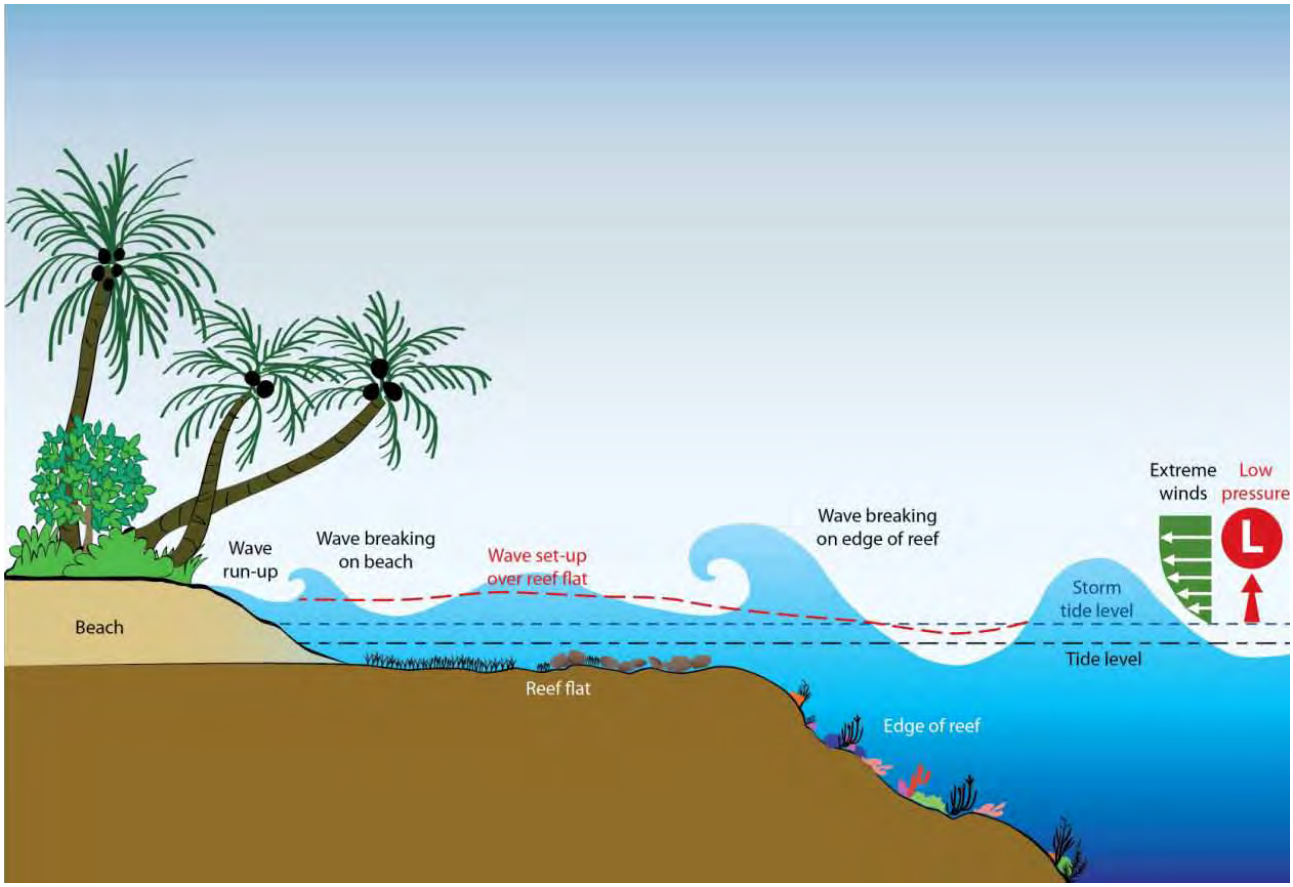
2 This situation highlights the difficulties often encountered in aid coordination when funding is project based. In an approach focused on programmatic outcomes, the activities would have been identified, including their relevant sequencing. Development partner engagement would also have been sought and secured by the Government, had it been equipped with the prioritised programme of work.

for Mangaia Island. The tender was won by a joint proposal from SPC's Applied Geoscience and Technology Division (SOPAC) and NIWA. The Mangaia Island Council interacted with the SOPAC and NIWA scientists during the planning and implementation of the PACC project.

Phase 2 – Situation analysis (technical assessments A and B)

Property and infrastructure in the coastal areas of the Cook Islands are highly vulnerable to coastal hazards, which are exacerbated by climate change and sea level rise. Coastal bathymetry causes waves, wave set-up, waves breaking and wave run-ups, as illustrated in Figure 3.2.

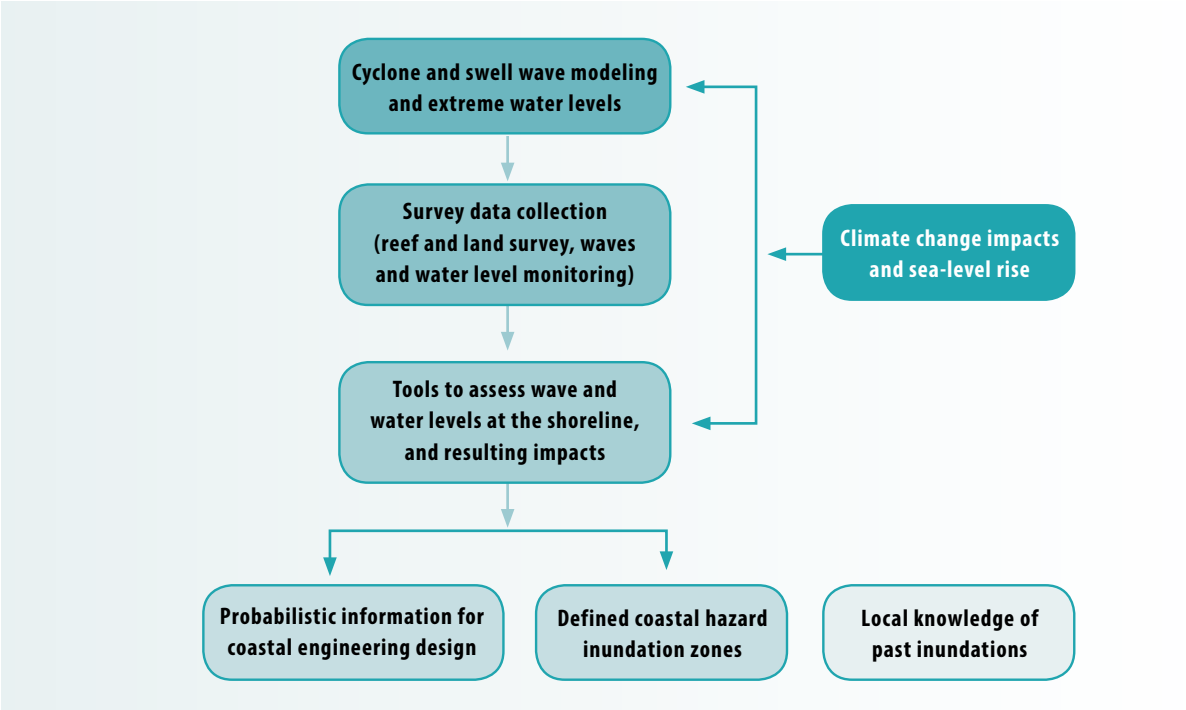
FIGURE 3.2. Coastal inundation depends on a complex set of factors such as weather, bathymetry and tide, as well as coastal physical characteristics. (Source: Stephens (2011).)



The team used a combination of 'impacts first' and 'vulnerability first'[3] approaches. Taking the 'impacts first' approach, the scientists examined historical weather and climate patterns, including cyclones. The scientists also identified the likely risks that communities may be exposed to due to coastal inundation during extreme water levels and wave conditions. Technical aspects of weather and climate conditions (and associated risks in Phase 3) were assessed by a team from SPC-SOPAC and NIWA, with assistance from the Cook Islands MOIP and the Cook Islands Meteorological Services, as summarised in Figure 3.3. Information from the local communities about inundations in the past was collected during the risk assessment phase.

3 The 'impacts first', also called 'science first', approach involves identifying climate change scenarios using scientific climate models, assessing impacts based on projected climate change scenarios derived from the modelling exercises, identifying, assessing and selecting relevant adaptation measures, recognising underlying uncertainties, implementing the adaptation measure and assessing the outcomes. By contrast, the 'vulnerability first' approach starts with the assessment of current vulnerabilities of communities. It identifies local sensitivities and resilience of the natural and human systems to climatic hazards, their local priorities to climatic variability and viable adaptation strategies, and actions required to improve their resilience. It also considers projected climate conditions at this stage.

FIGURE 3.3. The basic process adopted by the project team in the Cook Islands PACC project. (Source: Stephens and Ramsay (2012).)



Phase 3 – Problem analysis (technical assessments B and C)

Building on the initial problem analysis carried during Phase 2, NIWA scientists undertook a detailed modelling exercise to address questions such as:

- How will climate change and sea level rise impact on cyclone and swell conditions and hence on extreme wave and water level conditions at Mangaia?
- How will this influence coastal wave set-up, run-up, and overtopping the shoreline; and what will be the effects on coastal inundation along the village, harbour and airport shorelines of Mangaia?

This phase also involved a combination of 'impacts first' and 'vulnerability first' approaches. As part of the exercise the scientists developed an Excel-based tool called the Cook Island Coastal Calculator (CICC). This calculator allows assessments of extreme wave and water levels at the shoreline, wave set-up, run-up and overtopping under different climate change and sea level rise projections.

The CICC scenarios were compared against historic cyclone events, and events that the communities could remember, including cyclones in 1944, 1987 (cyclone Sally) and 2005 (cyclone Meena). In the Mangaia communities of Oneroa, villagers' recollections of water run-ups were recorded on a satellite image of the village frontage, using a geographic information system (GIS). Community facilities were also mapped. Calculations from the CICC were calibrated against this information.

Decisions about criteria to use for identifying adaptation pathways and measures were based on timeframes (planning horizons) set by the communities. Community-based discussions and scientific considerations led to decisions about possible scenarios for sea level rise under different timeframes. Community members decided on the following criteria for scientists to use, when considering effects of possible climate events:

- For a 25-year timeframe, a severity of cyclone event with an average recurrence interval of 50 years (a 40% possible chance of occurring over this period);
- For a 50-year timeframe, a severity of cyclone event with an average recurrence interval of 100 years (a 39% possible chance of occurring over this period).

The 25 and 50 years planning horizon largely reflected the estimated lives of the Mangaia community facilities, such as homes, village halls, schools, hospitals and administration buildings, and design codes for government structures. These parameters were used in the CICC, to identify present and future wave run-up levels. Figure 3.4 is a GIS map showing the physical location of buildings and predicted wave run-up under the different scenarios. Based on the modelled and historic run-up levels depicted in the GIS map, the Oneroa community identified those facilities at risk along the Oneroa frontage. Other drivers of cyclone inundation risk were also considered, including increase in width of the channel at the wharf (or other channels over the fringing reefs), roads that ran from the village through the makatea (raised coral atoll) to the shoreline, and removal of vegetation between the road and the shoreline.

FIGURE 3.4. Coastal areas near Oneroa village (Cook Islands) showing key community facilities at risk from coastal inundation under different scenarios using the Cook Islands Coastal Calculator.

Phase 4 – Solution analysis (technical assessments D, E and F)

Decision-making criteria for adaptation responses were jointly determined by the scientists and community members, as more detailed scientific information became available. The Oneroa community identified two climate adaptation strategies:

- Develop no further infrastructure in areas prone to cyclone run-up over the next two generations;
- Implement risk reduction and adaption options identified in the Mangaia Island Administration's annual planning and operational activities.

These two strategies and the coastal inundation scenarios helped the community to identify their desired adaptation pathway and short-, medium- and long-term measures.

Several factors were considered including the level of risk people are willing to live with (i.e. their risk preference), resource constraints, soft versus hard options, the desire to reduce exposure, the need to adapt to changing conditions, and the option of retreat as a last resort.

In the short term, risk reduction options identified were:

- Improve evacuation routes inland from the village;
- Limit new road developments down to the shoreline along the village frontage;
- Encourage landowners not to build new residential houses on the seaward side of the road;
- Encourage planting of natural vegetation between road and shoreline.

In the medium to longer term, the following risk reduction options were identified:

- Rebuild houses with raised floors during any renovation in areas that could be inundated;
- Progressively move essential infrastructures inland.

It was also agreed that if structural measures such as seawalls should be necessary, these would be located close to the level of the first makatea bench rather than at the shoreline.

This is where the research phase of the PACC project ended. The implementation of the identified options was then left to the Government agencies to follow through.

Conclusion

This case study illustrates the relevance of a combined 'impacts first' and 'vulnerability first' approach to climate risk management. Early consultation with the local community helps to identify locally relevant climate change risks to inform on-the-ground response measures, which may differ to what a national government for example may consider important. Identifying relevant climate change risks using an 'impacts first' approach early in the process allows the community to discuss impacts early on, alongside their 'vulnerability first' assessment. Detailed scientific assessments inform and help communities to confirm the problem and identify, develop and implement coastal risk reduction and climate change adaptation measures. In this case, scientists and community members worked together to confirm the problem and identify criteria for community solutions. This case study shows how robust technical analysis and community knowledge can complement each other, and inform the selection of measures that suit the local context and community risk preferences.

CASE STUDY 2 – The Nauru PACC project: simultaneous national and local level mainstreaming

This case study, based on the Nauru PACC project which addresses the country's water security issues, draws on government information (Government of Nauru, 2012a,b,c), other reports such as the National Communication on Climate Change, and discussions with Ms Mavis Depaune, PACC Nauru Project Coordinator, and Mr Hazelton Buraman, IWRM Project Coordinator.

The project followed a standard project development cycle and elements of climate risk management, although this was not explicitly identified. The following features of the project are highlighted in this case study (aligned with the respective project phases):

- The establishment of a high-level steering group as well as a technical and inter-agency steering group to support the mainstreaming process (Phase 1);
- Stakeholder-based processes for climate risk management decisions at national and sectoral levels, supported by sound technical information and advice, including the collection of new empirical data (Phases 2 to 4), and identifying relevant selection criteria for selecting the preferred adaptation pathway and specific adaptation technological solution (Phases 2 to 4);
- Use of multi-criteria analysis to make informed step-wise choices, recognising limited quantitative and qualitative information (Phase 4).

Project background

Water is listed in Nauru's NSDS as a development goal, to "provide a reliable, safe, secure and sustainable water supply to meet socio-economic needs" (Government of Nauru, 2005, 2009). Nauru's MDG report states that it is either 'off-track' or 'mixed' in its social sectors, such as water security, sanitation and human health (PIFS, 2011). Nauru's water sector is highly vulnerable to weather and climate variability. Much of the population depends on rainwater harvesting, groundwater and costly desalination to meet daily needs. Freshwater resources are vulnerable to fluctuations in rainfall that limits recharge into the few groundwater aquifers. There is potential for over-harvesting and saline intrusion from rising sea levels and storm surges. Groundwater is also under threat from pollution due to inappropriate sanitation options and unlined waste disposal sites. This makes water security a development as well as a climate change issue. Another driver of risk is the unreliable supply of electricity to operate pumps that draw groundwater. A regular supply of electricity depends on imported fossil fuel, which depends on shipping frequency.

Nauru identified water security as its highest priority for the PACC project. The Nauru PACC project team used the vulnerability and adaptation (V&A) assessment approach (Nakalevu, 2006) to identify adaptation measures at the strategic and local levels. The team analysed existing literature and information, and assessed vulnerability to weather and climate hazards, to identify adaptation measures suitable at the district and household levels. Steps followed under the Nauru PACC project closely align with those in the classic seven-phase process (Table 3.3).

TABLE 3.3. The Nauru PACC project process.

NAURU PACC PROJECT STEPS	CORRESPONDING PHASES IN THE SEVEN-PHASE PROCESS
Establish PACC team, technical working group and community consultation group. This included: • Identification of relevant stakeholders directly associated with national water management • Identification and sourcing of technical water experts	**Phase 1: Preparatory**
Diagnostic: vulnerability assessment To understand current development context, weather and climate hazards, sensitivity of people and adaptive capacity, several types of assessment were carried out: • *Environmental sphere:* Identify natural hazards, and human activities likely to affect water availability and quality • *Environmental and socio-economic*: Identify socio-economic factors affecting water demand, access to water, water storage and usage • *Socio-economic and governance sphere*: Identify capacity to cope, including institutional, legislation, and knowledge Risk assessment was also conducted implicitly	**Phases 2 and 3: Situation and problem analysis** Technical assessments: A, B and C
Prognostic – identification of adaptation measures at the community level Prioritise risks and adaptation responses at community level, and select preferred adaptation response for PACC project to implement	**Phase 4: Solution analysis – Risk reduction measures** Technical assessments: D, E and F
Demonstration project design • Design of the solar-powered ground water distillation plant	**Phase 5: Design**
• Installation of the solar-powered distillation plant • M&E of the demonstration project, including quality of distilled water	**Phase 6: Implementation, monitoring and evaluation**

Phase 1 – Getting started

The PACC project team was established within the Department of Commerce, Industry and Environment (CIE). This was supported by the Water Steering Committee, comprising CEOs of government agencies and state-owned enterprises (SOEs), and a technical working committee. Village-based stakeholder consultation groups were formed for two sites considered to be highly vulnerable and prone to drought conditions. The need for inputs from a water specialist was also identified at the outset.

Phases 2 and 3 – Situation and problem analysis (technical assessments A, B and C)

This assessment was based on analysis of existing national-level data, and information collected at the household level across the island, as summarised in Table 3.4.

TABLE 3.4. Sources of data and other information used in the PACC project in Nauru.

EXISTING DATA	SOURCE OF ADDITIONAL DATA
• PCCSP climate change report for Nauru • NAPA • PACC reports • Water, sanitation and climate outlook • Water policy • IWRM diagnostic report • Groundwater vulnerability report • Rainfall data • 2006 Census data	• Household survey: data on socio-economic status, water demand, water sources and supply (Nauru Housing Water Project) • Community workshops • Meetings with community leaders • Technical working group sessions

The national-level information provided an overview of hazards, risks and coping capacity, based on key indicators identified by the PACC team and community members. These included:

- Availability and quality of water resources;
- Storage and supply infrastructure;
- Access to water;
- Population density and water demand;
- Water use and usages;
- Income and livelihood;
- Degree of current reform underway in different sectors and institutional level adaptive capacity (governance).

A scientific analysis was carried out to identify improved supply options, including water quality, in view of a changing population. The analysis covered:

- Climatic conditions, such as temperature and rainfall, and their effects on rainwater availability;
- Interactions of weather conditions, hydrology and hydrogeology, and their impacts on groundwater recharge and quality;
- Threats to water security related to climate variability and climate change;
- Socio-economic features likely to increase risks to the water sector; and
- National-level water governance and adaptation capacity.

Demand and water-deficit scenarios were based on national-level assessment as well as detailed household-level analysis. This included an assessment of demand-per-person-per-day for potable and non-potable water; supply of and access to different sources of water; and the vulnerability of the current water infrastructure. Current and projected water demand was compared with the current supply, including water quality and sensitivity to climate change. Box 3.1 summarises the findings.

BOX 3.1. AVAILABILITY AND QUALITY OF WATER RESOURCES ASSESSED FOR THE PACC DEMONSTRATION PROJECT

Current: The availability and quality of water in Nauru is highly dependent on rainfall and influenced by climate patterns. Rainwater is virtually the sole source of freshwater in Nauru with very limited use of water produced from a few reverse osmosis plants. As a result, droughts are the most threatening climate hazard to the water sector. Droughts also threaten the groundwater quality and water-dependent ecosystems, especially non-coastal agroforestry systems.

Future: While climate change modelling suggests droughts could become less frequent, they will always remain a threat to Nauru. Sea level rise is likely to threaten groundwater quality by lifting the groundwater level, allowing more contaminants from the surface to reach the groundwater.

The following table summarises water resources in Nauru. Possible effects of climate change are signalled between brackets: (–) for a reduction, (0) for no significant change, (+) for an increase.

The national-level supply and demand analysis was used to inform problem and solution decisions, to formulate water policy, and identify adaptation strategies to strengthen water security across local districts.

The PACC team and stakeholders identified priority communities, as well as adaptation measures to improve household water security and resilience to projected climate change. For each district, the information highlighted the water threats, and factors affecting the availability of freshwater and coping capacity. These were discussed with the community to identify a set of vulnerability criteria. The assessment is summarised in Table 3.5 for Aiwo and Location communities. These were further refined during the Phase 4.

WATER SOURCE	AVAILABILITY	QUALITY
Rainwater	**Inconsistent (0)** Frequent drought (–) Heavy rainfall (+)	**Fresh (0)**
Groundwater	**Permanent (0)**	**Brackish/contaminated (+)** • Mostly brackish but varies depending on rainfall and locations • High level of faecal contamination
Seawater	**Permanent (0)**	Saline (0)

Source: Government of Nauru (2012a)

TABLE 3.5. Summary of household (HH) survey-based vulnerability assessment, Aiwo and Location communities.

VULNERABILITY INDICATOR (VI)	PARAMETER	LOCATION	AIWO
VI-1. Availability and quality of water resources		Moderate vulnerability	Moderate to high vulnerability
	Water availability	Rainwater (frequent drought) Groundwater (no access) Seawater (coastal access)	Rainwater (frequent drought) Groundwater Seawater (coastal access)
	Water quality	No data on groundwater quality in Location; likely to be brackish Sea level rise likely to increase the risk of groundwater contamination	Rainwater in lower Aiwo often carries dust from roofs Pollution from oil (petroleum) can be found in several wells in lower Aiwo High rate of contamination from faecal bacteria Sea level rise likely to increase the risk of groundwater contamination
VI-2. Storage and supply infrastructure		High vulnerability	Moderate vulnerability
	Public asset	3 freshwater tanks (6000L), only 2 in use	3 freshwater tanks (6000L), 1 leaking 1 groundwater tank with solar powered pump
	Private asset	Storage tanks – average 5000L (95% of HHs) Rainwater harvesting facilities (98% of HHs)	Storage tanks – average 5000–9000L (90% of HH) Rainwater harvesting facilities (80% of HHs) Groundwater wells (25% of HHs)
VI-3. Access to water		High vulnerability	High vulnerability
	Primary source of freshwater	Desalinated water (70%)	Rainwater (50%) and desalinated water (50%)
	Secondary source of freshwater	Rainwater (30%)	Rainwater (50%) and desalinated water (50%)
	Access to a secondary source of water (non-potable)	0% of the population access to groundwater	25% of the population access to groundwater
	Water scarcity	30.5% of HH often lack water	37.6% of HH often lack water
VI-4. Density of population and water demand		High vulnerability	Moderate to high vulnerability
	Population density	5710/km^2	1196/km^2 (100% of land area) 3988/km^2 (30% of land area)
	Growth rate (2006–2011)	3.85%	2.09%
	Average number of people	Per HH: 6 Per dwelling: 11	Per HH: 6 Per dwelling: 11
	Average water demand	Per capita: 170L Per HH: 1000L	Per capita: 170L Per HH: 1000L
	Total daily water demand	214,000L	218,000L
VI-5. Water use		High vulnerability	Moderate to high vulnerability
	Water use	100% urban (100% domestic)	100% urban
	HHs using flush toilet	90%	90%
	Daily freshwater use per capita	Average: 169L During drought: 156L	Average: 130L During drought: 91L
	Daily groundwater use per capita	Average: negligible During drought: negligible	Average: 65L During drought: 104L

VULNERABILITY INDICATOR (VI)	PARAMETER	LOCATION	AIWO
VI-6. Income		Moderate to high vulnerability	Moderate vulnerability
	Average income per HH <$3,200	27%	5%
	Average income per HH >$7,800	32%	52%
VI-7. Sector reform and adaptive capacity		Moderate to high vulnerability	
	Sector reform	In progress	In progress
	Current adaptive capacity	Low	Low

Phase 4 – Solution analysis (technical assessment D, E and F)

The PACC team, technical working committee and community groups took a holistic approach to identify possible solutions to the water security related problems identified in Phases 2 and 3. Two levels of responses were considered: national and community-based.

NATIONAL

The team noted there is limited scope for increased economic development on Nauru, which has implications for development of an improved public water infrastructure. Nauru's reliance on fossil fuel for the production of desalinated water further increases its vulnerability. Fluctuations in fossil fuel prices as well as reliance on shipping services for fuel imports further increase risks related to climate change. The team also assessed current stakeholders involved in the water sector management, their roles, and their capacity, and concluded that overall national capacity in water management is low. The stakeholders noted that in the absence of an overarching water policy, a water sector plan and water management governance arrangements there is little scope for the government adopting a coordinated approach to tackling water security issues. They decided on two levels of adaptation response:

- National-level action to develop a water sector policy and water sector plan. This was to be developed in collaboration with the team undertaking a parallel IWRM project executed with the support of SOPAC. They also decided to formalise the combined PACC and IWRM inter-agency steering committee to facilitate better oversight of water management in the country, and improve coordination between the Utilities Corporation and CIE, and other agencies; and
- A community-based initiative to increase water supply using solar-powered desalination units.

COMMUNITY LEVEL (TECHNICAL ASSESSMENTS D, E AND F)

Access to multiple sources of water in each community was considered to be critical to ensure water security at all times, although the importance of different sources of water will vary depending on the conditions at the time. This is summarised in Table 3.6.

TABLE 3.6. Combined water uses for an average household with groundwater access in Nauru.

WATER SOURCE	ABOVE AVERAGE RAINFALL	LOW RAINFALL	EXTENDED DROUGHT
Rainwater	All uses	Drinking only	Not used (storage empty)
Seawater (desalinated)	Not used (no need)	Drinking only	Drinking only
Groundwater	Outdoor Laundry	Outdoor Laundry Personal bathing*	Outdoor Laundry Personal bathing* Cooking

** Subsequent assessment has suggested that the use of groundwater is not recommended for personal bathing, laundry and cooking because of the high contamination from faecal bacteria.*

Based on the V&A assessments and expert knowledge, the PACC stakeholders identified adaptation responses to suit the situation and risks in each community. The team decided that, for example, the Aiwo district needed a water supply system based on rainwater and groundwater. Without this, residents would have difficulty meeting their current water needs, let alone develop adaptive capacity for projected climate conditions. The team suggested five technical solutions for the Aiwo community to choose from (Table 3.6). Each adaptation measure was ranked against vulnerability indicators identified by the PACC team, and other indicators considered relevant by the local community, which also led to further elaboration of the vulnerability parameters identified during Phase 3[4]. Multi-criteria analysis (MCA) scoring was from 0 to 3 (0 being the lowest benefit and 3 the highest). The solution with the highest score – household-based solar purifiers – was selected (see Table 3.7). However, the selection was made without considering the costs associated with alternative measures, i.e. without the carrying out of a cost–benefit analysis.

[4] This is the reason why there is a slight difference between parameters listed in Tables 3.4 and 3.6.

TABLE 3.7. Water security adaption options and their relative assessments based on multi-criteria analysis of each option against each indicator for Aiwo.

	PARAMETER	RETICULATED GROUNDWATER WELLS FOR UPPER AIWO	RETICULATED GROUNDWATER WELLS FOR LOWER AIWO	IMPROVED RAINWATER HARVESTING SYSTEM FOR SELECTED HHS (ROOFING AND GUTTER)	IMPROVED RAINWATER HARVESTING SYSTEM FOR SELECTED HHS (FILTERS)	SOLAR PURIFIER FOR SELECTED HHS
Environmental						
VI-1	Water source available during drought	3	3	0	0	3
	Potential environmental impact	1	1	3	3	2
Socio-economic						
VI-2	Amount of water provided per capita	3	3	2	2	1
VI-3	Improved access to freshwater during drought	0	0	0	0	3
	Improved access to a secondary source of water	3	3	0	0	2
VI-4	Contribution to daily water usage (%)	2	2	3	3	3
	Health risk related to use	1	0	2	2	3
VI-5	Maintenance required	1	1	3	2	3
	Expected lifespan	2	2	2	1	1
VI-6	Reasonable running cost	3	3	3	3	3
	Economic benefit to the water sector	3	3	2	2	1
	Landowner acceptance	2	2	3	3	3
TOTAL		**24**	**23**	**23**	**22**	**28**

NB. Criteria V1-7 is not included here as that criteria relates to the national (cross sectoral) level assessment
Source: Government of Nauru (2012a)

Phase 5 – Design

Commercially available standard solar-powered household-based solar purifiers were identified for purchase. The units receive impure water (groundwater) through the solar-powered pump and disperse it evenly across the distilling unit. Solar energy heats the water which vaporises then condenses on the inside of the plastic enclosure, and is collected and stored in water tanks. This distilled water meets WHO drinking water standards.

NATIONAL STRATEGIC INSTRUMENT

The National Water, Sanitation and Health Policy was developed in parallel with the on-the-ground initiative. This was supported by key assessments and stakeholder consultations (Phase 5). The key elements of the instrument are summarised in Box 3.2.

BOX 3.2 KEY ELEMENTS OF NAURU'S WATER, SANITATION AND HEALTH POLICY

- Vision
- Goals
- Objectives
- Organisational implications of the policy
- Resource and financial implications of the policy
- Legislative and regulatory implications of the policy
- Policy implementation, monitoring and evaluation
- Responsibility for implementing the policy
- Review of policy and implementation plan

Phase 6 – Implementation, and monitoring and evaluation

The units were installed on the roofs of 19 households and one community catchment roof. The water produced is free of any contaminants. However, communities were initially reluctant to use the water because of their fear of oil contamination, which they experienced in earlier use of groundwater.

The PACC team established a monitoring programme for water quality, as well as to test its durability against local conditions. The solar purifiers are considered to be affordable, if the panels can withstand local conditions (Government of Nauru, 2012c). The lifespan of a solar purifier is 15 years. Maintenance is expected to be low because there is no complex filter system or chemicals involved, and no electronics or moving parts. The results of this pilot project will provide information to convince that solar-powered desalination is safe to drink. It will also help the Government decide whether to replicate the solar-powered household desalination units across the country. Before solar purifiers are rolled out, a life-cycle analysis is needed to identify maintenance costs, and additional capital investment. A cost–benefit analysis could identify the long-term economic viability of the proposed technology.

Conclusion

This case study demonstrates the importance of adopting a systems approach, focusing on identifying a local-level initiative as well as strategic responses required to strengthen short term and longer term development and climate risk management needs. Water security vulnerability, drivers at both national and local levels, and adaptation solutions were identified at both strategic and on-the-ground levels. The case study highlights the role that a high-level government steering group and technical and inter-agency committees can play, together with a stakeholder-based working group, to support local adaptation measures. It also demonstrates that it is important to bring in specialists from the beginning. The study also demonstrates the importance of collecting primary data to complement existing information in support of decision-making.

CASE STUDY 3 – Taro leaf blight management in Samoa: building resilience through crop improvement and germplasm conservation

This case study draws on McGregor et al. (2011) and Lal (2011), and describes an on-the-ground initiative based on germplasm conservation and crop improvement. While the project was designed to address a climate-sensitive disease affecting taro, and thus was not initially designed to specifically address the climate risk, the project is an example of investing in institutional strengthening that provides capacity to respond to changing climatic conditions. It is also an example of 'no regrets' mainstreaming, where investment in addressing current disease risks has the potential to strengthen the resilience of farming systems and reduce the vulnerability of a key staple crop to climate-sensitive diseases.

Key features highlighted in the case study (aligned with the respective project phases, although these were not explicitly followed in the project) are:

- The interdisciplinary approach, which helped identify a suite of projects (or programme of work) that collectively would produce a desired outcome (Phases 3–5);
- Investing in institutional flexibility and capacity to facilitate adaptation to climate;
- A 'no-regrets' adaptation measure that addresses current climate risks – addressing current risks is a good starting point for adapting to projected changes in climate and its effects of food security;
- Building partnerships across the region, across organisations and with communities to tackle a complex problem, as no one agency can be expected have all the required technical, human and financial resources;
- Using ex-post cost–benefit analysis to advocate for the replication of an adaptation measure (Phase 7).

Project background

Many traditional Pacific island crops are particularly vulnerable to disease because of generally low biodiversity in the islands and often narrow genetic base. Root crops are especially susceptible to diseases brought about by changes in weather and climatic conditions, such as taro leaf blight (TLB). Such diseases are often tackled using methods such as agrochemicals, integrated crop management and crop improvements through breeding programmes.

This case study discusses an initiative built on decades of conservation of plant genetic material, crop improvement efforts and scientific research including building knowledge of TLB and its response to specific climatic conditions. These activities effectively comprise Phase 1 of the project cycle; many of these activities were implemented over time through different externally funded projects.

Phases 2 and 3 – Situation and problem analysis

TLB is a fungal disease that thrives with high night-time temperatures and high relative humidity. TLB significantly reduces the number of functional leaves in a plant, and can reduce crop yield by more than 50%. The disease was first detected in Samoa in 1993, and it rapidly spread across the two main islands, Upolu and Savai'i.

TLB had a devastating impact on Samoan taro production. For five to six years after the arrival of TLB, little taro was consumed in Samoa: a distinct difference from 1989 census records that showed almost 96% of agricultural households growing and consuming taro. McGregor et al. (2011) estimate that Samoa suffered an annual loss in domestic taro consumption valued at WST 11 million and taro exports valued at WST 9 million.

Various factors contributed to the rapid spread of the disease in Samoa. Following a recent cyclone, Samoan famers had replanted with almost entirely a single variety of taro, which happened to be highly susceptible to TLB. Weather conditions at the time were conducive to the rapid spread of the disease and it reached epidemic proportions: strong winds, high relative humidity, and high night-time temperatures created ideal conditions for the spread of the fungal spores.

Given the projected changes in climate across the region that match preferred conditions for TLB, scientists suggest an increase in the likelihood of the TLB spreading to locations that are currently free of the disease.

Fiji, Tonga, Vanuatu, the Cook Islands and higher-elevation areas of Papua New Guinea are currently free of TLB, but could see TLB become established under projected average warmer temperatures combined with wetter conditions. Common traditional practices of free exchange of planting material between communities and lack of resistant varieties in the field are expected to exacerbate the risks.

Phase 4 – Solution analysis

When traditional methods for TLB control did not provide positive results, attention focused on introducing exotic varieties resistant to TLB, in particular from Asia and Palau. These TLB-resistant taro plants enabled Samoan farmers to cultivate taro once again. However, the new varieties were not ideal because of differences in taste. Attention then shifted towards taro breeding: crossing the newly introduced resistant varieties with the Samoan varieties preferred by Samoans at home and abroad, to develop varieties with acceptable flavour and also with a shelf life that would allow export by sea.

Phase 5 – Project design

The crop breeding programme combined specialist scientific knowledge of genetics and crop breeding techniques with farmers' knowledge. A classic plant breeding approach was adopted, involving collaboration between regional plant breeders from SPC, the University of the South Pacific (USP) Alafua Campus and the Samoan Ministry of Agriculture. There was also a high level of grower participation; farmer trials were conducted, together with community preference trials in Samoa (Samoans living abroad were not initially included). Farmer participation ensured field trials across many locations and a quick uptake of new varieties.

Partnerships with development partners were also critical. The initial breeding programme involved USP plant breeders and the Ministry of Agriculture staff in Samoa using their own funds. External funds of about WST 18 million (Aus$8 million) were obtained between 1994 and 2010 for:

- The TAROGEN project, from the Australian Agency for International Development (AusAID);
- DNA finger printing and virus testing protocol development projects, from the Australian Centre for International Agricultural Research (ACIAR);
- Assessment of TLB resistance, from the NZ Ministry of Foreign Affairs and Trade (MFAT).

These regional and bilateral contributions supported the breeding programme that eventually led to the introduction of TLB-resistant taro varieties in Samoa. AusAID also contributed to taro germplasm conservation at the Centre for Pacific Crops and Trees (CePaCT).

Phase 6 – Implementation

In an ideal situation a project is implemented once Phase 5 has been completed and funding and other inputs have been secured. Normally government agencies and/or non-government stakeholders would have developed a detailed budget, an implementation plan, and monitoring and feedback plans, including M&E indicators.

In practice this does not always happen. In the case of the TLB outbreak in Samoa, the TLB-resistant taro breeding programme took several years to get underway, due to delays in funding and the time it took to identify and access genetic material from other countries. Several years were also spent developing a cohesive crop improvement programme, which was based on genetic material sourced initially from Palau, and later from the Federated States of Micronesia, the Philippines, and other south-east Asian genetic material maintained in CePaCT. Such delays, with costs to local communities and loss in the export markets, could have been avoided if programmatic investment in regional ex-situ[5] germplasm banks had already been made, and technical capacity maintained at the regional level. Such an investment in institutional strengthening is a good example of a 'no-regrets' adaptation strategy.

[5] Ex-situ refers to off site (off farmers' field) conservation, usually in germplasm banks that hold crop genetic material.

Phase 7 – Ex-post cost–benefit analysis

To learn from initiatives, it is often useful to undertake an ex-post evaluation (i.e. after a project is completed), including an ex-post cost–benefit analysis. An ex-post evaluation of the crop improvement and germplasm conservation programme was carried out under a project funded by the Australian Department of Climate Change and Energy Efficiency (DCCEE) (Lal, 2011). Adopting a 'with-and-without' cost–benefit analysis, McGregor et al. (2011) showed that the benefits of the largely publicly funded TLB-resistant crop improvement programme far outweighed the costs, with significant benefits for both domestic consumption and export.

Production of taro for the domestic market increased from virtually zero in mid-1994 to 9000 tonnes in 2010. Over that period total local consumption was valued at WST 21 million (Aus$9.3 million) and the value of exported taro was estimated to be WST 1.1 million (Aus$0.5 million). The export value of taro for sale and subsistence between 1994 and 2010 was 10 times the cost of the breeding and germplasm conservation programme (estimated as a pro-rated cost of the regional CePaCT germplasm programme). The net benefit of the TLB-resistant taro breeding programme shows significant value. Yet the economic and social benefits could have been much greater if Samoa, or the regional germplasm banks, had already contained taro genetic material from the region and from Asia.

Conclusion

While reactive responses to risks helps meet immediate needs, countries must also adopt proactive 'no-regrets' strategies to minimise future risks of climate change. Strengthening foundational institutions, such as germplasm banks, is an example of such a strategy. Economic and social benefits of germplasm conservation, at the regional and national levels or in farmers' fields, could thus have a much wider and longer term value for the region. The TLB experience in Samoa is an example of a combined regional and national approach to conservation and crop improvement.

Vanuatu adopted the approach of encouraging conservation in farmers' fields. To safeguard against the loss in genetic diversity in crop genetic material collections, Vanuatu undertook to establish 'collections' in farmers' fields. The Vanuatu Agricultural Research and Technical Centre (VARTC) developed a pilot project to test and evaluate on-farm conservation by introducing new genetic material in Vanuatu's traditional cropping system. Part of the project was to allow 'natural' distribution of new genetic material through traditional cultural practices of exchanging planting material. The objective was to broaden the genetic diversity in village farmers' fields, by including some resistant varieties, thus providing protection against future epidemics and biological disasters. The trials also addressed desired eating and agronomic qualities.

McGregor et al. (2011) note that a social and economic assessment of the 'no-regrets' strategy of establishing 'reservoirs' of genetic diversity in farmers' fields is difficult, as the benefits do not become obvious until pest and disease outbreaks occur. Benefits will also depend on the maintenance of the genetic diversity in farmers' fields. Yet the project demonstrates the potential for risk minimisation by building on the traditional practices in the Pacific, of maintaining crop diversity in family gardens. This is an example of combining Melanesian cultural practice of openly sharing crop varieties, with a proactive 'no-regrets' approach to maintaining genetic material in regional and national germplasm collections, as well as reservoirs in farmer's fields; diversity in genetic material can be called upon in times of need to help meet food and nutrition security, including in the face of climate change.

CASE STUDY 4 – Solomon Islands PACC project: improved farm management as a first step towards adaptation to projected climate change

This case study draws on reports produced by UNDP (2006), Government of Solomon Islands (2012a,b) and McGregor and Supa (2012). It illustrates steps followed in the Solomon Islands PACC project to identify appropriate adaptation responses, recognising current development context, sources and drivers of weather and climate risks, and capacity and resource constraints.

The case study highlights the following:

- The engagement of technical experts to inform problem/solution analysis, and in the detailed design of an on-the-ground adaptation measure, particularly during Phases 4 and 5;
- Carrying out of a systematic problem/solution analysis of current and projected risks, including recognising current development needs, sources and drivers of weather and climate risks, local disaster management experiences and practices, and capacity and resource constraints (Phases 3 and 4);
- Undertaking cost–benefit and feasibility analysis of alternative measures to inform the adaptation choice (Phase 4) and the design (Phase 5);
- How community-based vulnerability and adaption (V&A) assessment can build local capacity and encourage local ownership of externally funded investments (but noting that such an assessment needs to be supported by robust scientific knowledge, if practical benefits are to be realised from limited resources).

Project background

Ontong Java is a densely populated set of low-lying atolls in the Solomon Islands. The residents are highly vulnerable to the effects of weather and climate extremes, such as extended dry periods due to El Niño-Southern Oscillation (ENSO) events. The islands are also highly vulnerable to the effects of cyclone-induced flooding and storm surges. The intensity, if not the frequency, of such extreme climatic events is expected to increase with climate change and sea level rise. The impact of extreme weather and climate conditions on food security is a major concern on the islands, especially given a recent decline in subsistence crops, and an increasing population. A recent sharp decline in income-earning opportunities has further added to food security concerns. The ban on bêche-de-mer (sea cucumber) harvesting has reduced cash incomes for purchasing rice and other staple foods.

Phase 1 – Preparatory

Initial preparatory work under the PACC project identified the need for a focus on food security and the agricultural sector in the Solomon Islands. This was based on a systematic assessment that involved a review of government documents and reports on development, disaster and climate change, including reports prepared for the First National Communication, NAPA, and NAP; in-country consultation with government and non-government stakeholders to identify their interests, and their role in the PACC project when implemented; and stakeholder workshops held to select the priority sector and community to target.

The selection of the agricultural sector and the Ontong Java community reflects the Solomon Island Government's development policy and other ongoing initiatives in the country. The consultation helped to identify the institutional arrangement for the PACC project, and the higher level support to be provided by the Solomon Islands Advisory Committee on Climate Change (SIACCC). The V&A report notes that "the church-organised group has a lot of influence in the community and there is a need to do a wider range of consultation with them before different adaptation activity can be carried out on the island" (Government of Solomon Islands, 2012a: p. 72). It also noted that the local chiefly system is strong and future consultation needs to be in line with the current structure. The V&A team recommended therefore that the first step towards developing capacity is to establish a community-based adaptation committee, which should recognise the role of church-based and community-based institutions, such as women chiefs.

Phases 2 and 3 – Situation and problem analysis (technical assessments A, B, and C)

IPCC Common Methodology (CM) was used that highlighted three areas: global climate change, including sea level rise; socio-economic development; and response options. The community-based V&A was completed using a detailed household survey. This provided information about community perceptions of trends in weather conditions and the frequency and impacts from recent key hazards. The effects of saltwater intrusion, drought, cyclones, and coastal erosion were recorded on livelihoods, water, food gardens, fishing grounds, transportation and communication. Loss of property and cultural sites, and hazard areas, were also mapped.

Vulnerability to weather and climate change on Ontong Java was analysed by the PACC team, who examined:

- Past and projected weather and climate patterns (rainfall, temperature), climate change and associated hazards (cyclones and droughts, sea level rise and storm surges); and
- Vulnerability to past weather and climate events, based on experiences in the agricultural sector, environment (forestry and biological diversity), freshwater resources, coastal zone and marine resources, human settlements and health, and water resources.

The PACC Project V&A Assessment Report (2011) for Ontong Java identified the following areas of importance:

- Subsistence agriculture and nutrition;
- Human health;
- Coastal environments and systems;
- Water resources;
- Marine resources.

In relation to food security, the PACC V&A Assessment Report (2011) identified several specific factors that needed to be addressed:

- Land availability to produce sufficient quantities of nutritional food for the family;
- Availability of giant swamp taro to sustain families during droughts and disasters;
- Accessibility of marine resources to exploit and earn income for buying imported foods to supplement locally available food;
- Access to markets for their goods, to earn income;
- Availability of transport to take goods to market and to buy food.

The loss of an alternative source of livelihood was also identified as an issue, with the 2011 ban of bêche-de-mer sales affecting the ability of local communities to purchase staples such as rice and flour.

Phase 4 – Solution analysis (technical assessments D, E and F)

Examining the results of the problem analysis in detail the team then identified possible adaptation responses to tackle those problems and the drivers of risks. They also noted adaptation strategies already adopted by the communities. Gaps in the capacity of households and communities to respond adequately to current weather and climate-related hazards were highlighted, and the team identified their key constraints in responding to changing conditions. Constraints identified included the lack of context-specific information, the traditional tenure system affecting agricultural expansion, and the absence of public policy and clear strategies to guide sector-level responses. The team also identified gaps in current disaster risk management and sector-level strategies to address the problems.

In response to these issues, various adaptation responses were identified. Broad priority strategies identified in the V&A report included:

- Climate change awareness;
- Education and training;
- Capacity development in agriculture, sustainable environmental stewardship, resource management training and planning, and phased relocation options, plans and strategies.

Of the different specific response options identified, the V&A report concluded that improving domestic food production showed the best prospects for enhancing food security on Ontong Java in the short to medium term[6]. This was based on the following criteria:

- Effectiveness with regard to the hazard;
- Expected costs;
- Technical feasibility;
- Social and cultural feasibility;
- How quickly the adaptation option could be implemented.

The PACC V&A report also identified a number of specific on-the-ground agriculture-related activities that addressed different causes of the food security problem.

In mid-2012, a cost–benefit analysis of the proposed adaptation responses was conducted to help inform the final selection of preferred adaptation measures for the PACC project to implement. Given the limited resources and time constrains of the PACC project, the economic team, with input from agricultural specialists, suggested focusing the analysis on options identified in the V&A report, and narrowing this further to two causes of reduced food production in Ontong Java:

- Coastal salt contamination of swamp taro due to storm surges and coastal flooding;
- Poor soil due to limited humus.

The team then identified three broad responses for improving food production on Ontong Java:

- Establish protective measures to reduce saltwater contamination in food production areas;
- Introduce root crop varieties and cultivars that have tolerance to salinity;
- Modify soil and food production environment.

In the first instance, a choice was made between these three responses based on expert judgement of the PACC team. The team noted the use of coastal barriers to protect farmland from salt contamination in countries such as Palau. To replicate such a response measure, substantial and expensive hydrological and engineering studies would be required, and given the limited financial resources and time constraints, the PACC team decided against including a coastal barrier in Ontong Java as an adaptation measure.

Three of the Pacific region's root crop experts were consulted about the effectiveness of introducing salt-tolerant varieties of root crops. They agreed that before introducing such crops, extensive breeding for acceptable taste would be needed. This would require a long-term investment, which was overly optimistic for the PACC project in its short project-based funding. It was also noted that while potential gains could be achieved from accessing swamp taro suckers from the Federated States of Micronesia (FSM), which has over 50 swamp taro varieties, other considerations were also important if a breeding programme was to be considered for Ontong Java, including:

- The salinity level in the coastal farms on Ontong Java compared with the tolerance of the plants;
- Swamp taro is a relatively minor crop in the region and globally, and there are no formal breeding programmes. If attempted, a breeding programme for salt tolerance would be a long process with an uncertain outcome.

Given the expert judgements and capacity issues on Ontong Java and in the region, it was decided not to focus the PACC project on the introduction of salt-tolerant planting material.

By this process of elimination, the decision was made to focus on improving soil condition for food production. That is, in the end the selection of the adaptation measure of choice reflected resource constraints and the short duration the PACC project's life precluding development of salt-tolerant varieties (which was the original preferred adaptation option). Within this response option, many different activities were identified and subject to further design for the PACC project for implementation; the final choice of the PACC activity design, too, was made using cost–benefit analysis.

6 The PACC team had initially decided on the introduction of salt-tolerant variety. This was changed after systematic cost–benefit analysis had been carried out.

Phase 5 – Design

To identify the most appropriate activities for improving the soil condition, McGregor and Supa (2012) referred to the historical knowledge of people on Ontong Java and other atoll islands, of organic matter composting. They note "the challenge is to take existing scientific knowledge on sustainable organic production systems, together with experiences in food production from other atoll situations, and apply them in an effective way to the Ontong Java context." This approach, together with considerations of other ongoing activities by a local church-based organisation, and further cost–benefit analysis, led the team to focus on improving the organic environment in which crops are grown in Ontong Java.

The economics team, in consultation with other farming experts, then undertook cost–benefit analysis (CBA) of options that could be used to modify the organic environment. Specific options subjected to CBA included the following activities:

- Improving composting techniques that increase the volume and quality of available compost;
- Using agroforestry that involves the use of nitrogen-fixing trees and legumes;
- Growing vegetables in raised beds and containers (including hydroponics), and improved home gardening techniques;
- Establishing small nurseries for vegetable seedlings and agroforestry planting material;
- Introducing a 'soils school' extension process, so people understand their soil and how best to utilise it for sustainable food production.

A 'with' and 'without' CBA was then carried out. The 'with' analysis identified key inputs required for the activities and their costs, assuming the on-the-ground PACC initiative was completed in a three-year period. For assessing activity 'without' the PACC project, the team assumed no further reduction in taro production would occur over the next decade – although with climate change, taro production could be expected to decrease. The total cost of the three-year project is approximately S$I2.5 million (US$ 350,000). The team also determined the benefits from increased nutrition of the people, one of the expected outcomes of the food security project. The analysis found that the proposed on-the-ground initiative, under at least three of the four scenarios, was economically viable and operationally feasible, even with the most conservative assumptions about improvements in human nutrition through increased food security.

Conclusion

In this case study, the detailed V&A assessment helped identify more pressing drivers of vulnerability – poor farm productivity – even though the available funding was to support adaptation to climate change. The case study also highlights that it is critical to identify and engage relevant technical experts at the earliest stage possible. In this project, the involvement of agricultural farm specialists and an economist, albeit at a late stage, helped identify more realistic and feasible response options considering the limited resource and time constraints of the PACC project. The initial preparatory Phase 1 and situation analysis during Phase 2 should identify the need for technical input. The case study also demonstrates the value of cost–benefit analysis to make informed choices, even if all the costs and benefits cannot be quantified in monetary terms.

CASE STUDY 5 – Climate proofing roads in Western Guadalcanal, Solomon Islands

Climate proofing incorporates issues of climate into a project after it has already been designed and sometimes implemented. It is done when it becomes clear that climate risks could undermine the success of the project or its sustainability. This case study examines the Solomon Islands Road Improvement Project (SIRIP) in Western Guadalcanal, and its retrospective climate proofing when it was realised that the initial design did not account for recent experiences with extreme weather events. The case study draws on a report prepared for the Australian Department of Climate Change and Energy efficiency (Lal and Thurairajah, 2011).

The case study highlights the following features, which are relevant where a mainstreaming exercise involves climate proofing an existing project:

- Revisit the seven-phase project cycle using a 'climate lens';
- Additional climate risk technical analysis is required, including identifying weather and climate risks as well as the changes in underlying drivers of risks as a result of changing climate (technical components A–F of CRM);
- CBA is a useful tool, first to identify the broad strategies for climate proofing, then detailed CBA of the climate proofing options, for example (in this case) the physical elements to withstand increased intensity of floods and flooding;
- The need for climate proofing could be avoided if an environmental impact assessment (EIA) process[7] was carried out for all projects, with climate risks considerations included along with environment and other development criteria.

Project background

The Solomon Islands regularly experiences climate-related extreme events, including heavy rainfall, cyclones and coastal storm surges. These events cause flooding-related hazards and significant economic losses as well as sometimes loss of lives. In response to regular flooding and its impact on vital infrastructure, the Solomon Islands Government, with the assistance of the Asian Development Bank (ADB), the Australian International Aid Agency (AusAID), the New Zealand Aid Programme (NZAID) and the European Union, undertook improvement of existing road infrastructure.

The tender for the SIRIP was won by an international engineering firm, Cardno Acil Ltd. The initial design reflected disaster risk considerations based on recent historical events. The project was about to start when a major flood occurred in 2010. A decision was made to review the SIRIP project and to improve the road design to withstand a higher category of weather event; that is 'climate proof' the planned road infrastructure.

Phase 1 – Preparatory

A multidisciplinary consultancy team, including engineers, environment specialists and a climate change expert, was established to review the SIRIP project design.

Phases 2 and 3 – Situation and problem analysis (technical assessment A, B, C and D)

Several different types of assessment were carried out, including:

- Vulnerability and risk assessment;
- Hydrological and climatic conditions;
- Geological instability and landslide;
- Climate change as a development challenge;
- Community consultation on climate change vulnerability and existing adaptation.

[7] In an EIA process the government evaluates the impacts (including ecological, economic and social aspects) of a proposed project. Through an EIA, a government encourages developers to minimise any negative environmental, social and other economic impacts.

These assessments provided the following information:

- They identified historical climate data for Solomon Islands and Global Climate Model (GCM) projections, and rainfall-run off projections using a PNG model;
- They identified, confirmed and mapped road areas vulnerable to flooding;
- The community-based V&A assessments provided community experiences related to weather and climate change, and impact on lives and livelihoods, including loss in income due to inability to get to work by road;
- An adaptation assessment matrix reflecting review of the design of key infrastructure components including coastal roads, bridges, culverts and other hard structures, with respect to the impact of different levels of precipitation and flooding.

The project team essentially assessed if the original project design met projected climate risks, considering issues such as:

- The effects of climate change on local ecological, socioeconomic and physical factors and their potential impact throughout the life-span of the project;
- The possible cumulative impacts of primary and secondary effects of climate changes during the life of the project; and
- Uncertainty associated with climate and flooding projections.

The risk assessment was thus used to identify relevant engineering and non-engineering adaptation responses. Non-engineering solutions identified included increasing land cover or coastal buffers and adding carbon storage capacity, reflecting effects of climate change on the environmental system as a whole. However, although considered to be inexpensive and flexible, these non-engineering solutions were not pursued further (as these were considered beyond the scope of the current project). The team decided to pursue an engineering solution, and the original designs of roads, bridges, culverts and other structures were reviewed for their ability to withstand increased flood risks.

For each physical structure, engineers determined the level of risk that could be tolerated, taking into account the magnitude of flooding events, design standards for structures, and serviceability of the roads[8], "as far as economically feasible" (Cardno Acil, 2010a: p.11). Based on this, three project designs, plus the 'do nothing' option, were identified. Table 3.8 (next page) summarises the issues considered by the team in the problem analysis phase.

Phase 4 – Solution analysis (technical analysis D, E and F)

Cost–benefit analysis (CBA) was the primary tool to inform selection of the preferred option for the upgrade of the road design reflecting climate risks.

The team first identified 'with' and 'without' climate change scenarios. Several different 'without' scenarios were assumed, depending on the different options that were originally considered: the current weather and climate pattern where at least 1-in-2-year flows could be tolerated as the base; and for climate proofing of roads to a higher threshold, intensity of 1-in-10-year events was assumed when considering different combination of upgrades to key components of roads, culverts, bridges etc. In 1-in-10 year events some flooding of the structures may occur but vehicles with higher clearance could still pass through (these were the initial SIRIP conditions).

The 'with' scenario was based on IPCC's Fourth Assessment climate projections, and the use of rainfall run-off models from PNG. Three original design options were revised to reflect changes in climate risks. These options were subject to CBA, together with the 'do nothing' option. The original options were:

- Option A: Restore road network to pre-February 2009 status but with increased flood resistance by improving identified low lying sections via raised road and new bridges.

[8] It seems from available documentation and follow-up discussions with the Cardno team in the Solomon Islands that the impact of increased potential for landslides and debris from deforestation activities was not considered in the revised infrastructure designs.

TABLE 3.8. Summary of key issues identified during the problem analysis phase: impact of increased flooding on the roads.

Likelihood of occurrence in project site	High
Vulnerability	High at climate-sensitive hotspots such as low-lying coastal bridges and road sections and river floodplains
Consequences – possible problems and damage	• Gully erosion • More severe floods • Water build-up • Overflow and mud/debris deposits making roads impassable and destroying bridges (wash-out) • Landslides and slips of the slopes
Proposed preventative measures	• Apply a safety factor in bridge and road design and raise their level • Increase size and number of protective engineering structures (hydraulic structures, high bridges) • River training (i.e. changing the course of the river) • Increase land cover in upper water catchment through reduced logging and better forest management • Raise pavement and add drainage • Improve surface drainage and its maintenance
Risks/benefit	• Engineering options: additional culverts and higher bridges are effective but expensive • For engineering solutions to be effective, adequate routine maintenance must be performed continuously • Effectiveness of non-engineering solutions (such as using vegetation) to reduce runoff will be limited to specific locations • Revegetation in upper catchment can be a community-based activity that provides income to villages affected by floods

Source: Adapted from Cardno Acil (2010b)

- Option B: Upgrade and replace existing infrastructure such that all crossings are capable of conducting a 2-year flow.
- Option C: Upgrade and replace existing infrastructure such that all crossings are capable of conducting a 2-year flow and significantly increasing the flood resilience of key crossings.

Cost-benefit analysis was done in two stages. CBA of the original options (A, B, C) was revisited taking into account additional damage that occurred in the 2010 floods, as well as including some other changes to the upgrade options along the road. A more detailed CBA of the proposed changes to key infrastructure elements was conducted to ensure climate proofing to withstand the projected climatic conditions by 2030 (called CBA-CCA).

For CBA-CCA, the economists identified the following information for the different 'with' options as well as for the revised 'without' climate change scenarios (which reflected the baseline costs experienced in 2010):

- Financial costs, including the capital costs of the structures, operation costs and respective regular maintenance costs;

- Financial benefits of the road infrastructure repairs and improvement for communities; benefits of the 'with improvements' included avoiding loss in earnings when structures are under floodwater, and when breaks in the river crossings prevent movement of vehicles and people.

The team also identified non-financial benefits, such as those related to increased access to health and education facilities in times of floods. These benefits were assessed using traffic surveys and social surveys of communities serviced by the road. Recognising uncertainties associated with climate change projections of rainfall, sensitivity analysis was also conducted varying average 20-year rainfall intensities.

The revised SIRIP 2 Option B was selected for implementation, which incorporated changes to the design of various elements of the Honiara–Lambi road in Guadalcanal Province from White River to Naro Hill, reflecting increased climate risk considerations. Sensitivity analysis varying projected average 20-year rainfall intensities did not change the conclusion of Option B-CCA response as the preferred strategy.

Conclusion

This case study demonstrates several issues regarding climate proofing of on-the-ground development projects. If a project has been designed and not implemented, climate risks can be incorporated, albeit with the additional costs of revisiting the situation, as well as building to higher standards.

Additional technical analysis is required to climate proof an original project design. Such analysis will include additional work to identify likely weather and climate risks as well as the changes in underlying drivers of risks as a result of changing climate. These are the same key technical components of CRM (A, B, C, D and E) carried out during Phase 2, 3 and 4 of a project that was developed considering climate change risks from the outset.

The project also highlights the use of CBA in climate proofing, here initially identifying the broad strategies for climate proofing, followed by a detailed CBA of design of specific physical elements to withstand increased intensity of floods and flooding.

It is likely that had Solomon Islands conducted environmental impact assessment (EIA) of the original SIRIP infrastructure project, climate risks would have been included before the project was approved for implementation. A combined climate risk and EIA process, or environmental risk assessment (ERA; Hyett, 2010)[9], would include:

- Integrated scientific, social and economic information and traditional knowledge about climate risks and risk management;
- Expert judgments about risks and risk management, particularly when baseline information is unavailable;
- Knowledge of perception of risks, and a country's risk tolerance threshold.

The EIA process was not followed for the SIRIP by the Government or the ADB because this project was about improving an existing road, and not a new development. The Solomon Islands Government has an EIA process, and this can be expanded to include climate risk considerations even if it is not a criterion formally required under current legislation. Ultimately, national governance systems would need to be strengthened if an ERA-based approach is to become an integral part of decision-making. This would include review of the Environment Act to include climate risk considerations; revising the EIA procedure and including explicit consideration of climate risk during approval processes; and institutional capacity to assess development projects for climate and other risks, together with environment and social and economic development criteria.

9 Through the ERA the government could require higher standards for physical assets in hazard-prone areas.

CONCLUDING REMARKS

Efforts to mainstream climate risk into national development planning are still at an early stage in the Pacific region and globally. Many different approaches have been tried in the Pacific, with different degrees of effectiveness. Climate change mainstreaming in the region could be strengthened further using the seven-phase approach for strategic and on-the-ground level initiatives proposed in this guide.

As described, the approach can be applied at the strategic level, either for developing new strategic instruments such as policies, plans or legislation, or to climate proof existing strategic instruments. Adapted for mainstreaming at the project level, it can also be applied to on-the-ground initiatives, again from the initial stages and throughout the project process, or as an 'add-on' to climate proof existing designs or projects already implemented.

Mainstreaming is a broad concept, and there are many ways of doing it. The approach in this guide is intended to help diverse stakeholders to incorporate climate risks into their planning and activities at different levels. When climate risks have been considered and technical analytical steps have been systematically completed, policies, plans, projects and decisions at all levels will be more robust to the uncertainties of the future.

As experience and knowledge of climate change and mainstreaming grows, it is hoped that lessons will be shared and applied to improve the process for integrating climate risks.

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PACIFIC ADAPTATION TO CLIMATE CHANGE (PACC) PROGRAMME

The PACC programme is the largest climate change adaptation initiative in the Pacific region, with activities in 14 countries and territories. The programme began in 2009 and is scheduled to end in December 2014. PACC is building a coordinated and integrated approach to the climate change challenge through three main areas of activity: practical demonstrations of adaptation measures, driving the mainstreaming of climate risks into national development planning and activities, and sharing knowledge in order to build adaptive capacity. The goal of the programme is to reduce vulnerability and to increase adaptive capacity to the adverse effects of climate change in three key climate-sensitive development sectors: coastal zone management, food security and food production, and water resources management.

www.sprep.org/pacc

This Mainstreaming Guide provides a step-by-step framework for incorporating climate change risks into development planning and decision-making processes in the Pacific. The Guide covers mainstreaming at two broad levels: the strategic or policy level, and 'on-the ground' initiatives or project level. The approach follows standard policy and project cycles, and combines elements from climate risk management. Examples and case studies from the region are used to illustrate mainstreaming as it is happening in practice. The Guide is targeted at country practitioners, staff in regional governments and organisations, and development partners, to assist and support their efforts to integrate climate risk into development planning and decision-making processes. The Guide is an output of the Pacific Adaptation to Climate Change (PACC) programme.