ADAPTING TO CLIMATE CHANGE

INCORPORATING CLIMATE CHANGE ADAPTATION INTO DEVELOPMENT ACTIVITIES IN PACIFIC ISLAND COUNTRIES

A SET OF GUIDELINES FOR
POLICYMAKERS AND DEVELOPMENT PLANNERS

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GEF

PICCAP
our islands, our lives...

A SET OF GUIDELINES FOR POLICYMAKERS AND DEVELOPMENT PLANNERS

This report was prepared for the South Pacific Regional Environment Programme by John Campbell and Neil de Wet of the International Global Change Institute (IGCI). University of Waikato, New Zealand.

Executive Summary

This document has been developed as a draft set of guidelines for the implementation and funding of adaptation to climate change and sea level rise in Pacific Island Countries.

It has been developed through a process involving consultation and discussion with personnel involved in climate change activities, development planning and environmental management in Pacific Island Countries.

Pacific Island Countries have been identified as being particularly vulnerable to the effects of climate change and associated sea level rise (CC and SLR).

As the Pacific Island Countries are not significant greenhouse gas producers, they can take minimal direct action to reduce global greenhouse gas emissions. Even with international initiatives to reduce global greenhouse gas emissions, Pacific Island Countries will need to take action to adapt to the adverse effects of CC and SLR.

Optimal adaptation approaches will be anticipatory approaches that facilitate the inclusion of adaptation options into development.

Three strategies of adaptation are proposed to facilitate the inclusion of adaptation options into development:

- Strategy 1: Incorporating CC and SLR considerations into new development proposals;
- Strategy 2: Developing proposals which are specifically aimed at addressing the possible effects of CC and SLR;
- Strategy 3: Developing proposals for strengthening institutional and technical capacity to facilitate Strategies 1 and 2 and manage the effects of CC and SLR.

Strategy 1 makes use of a step-by-step CC and SLR adaptation process **to ensure that all new normal development proposals take full account of CC and SLR considerations.**

Strategy 2 and 3 adaptation proposals may be identified and initiated by the proposed National Climate Change Co-ordinating Team and may also be submitted to the CC and SLR adaptation process.

All three strategies may receive support from international funds dedicated to adaptation in vulnerable developing countries.

One such funding source is the Clean Development Mechanism, which is expected to generate large sums of money for adaptation in developing countries vulnerable to CC and SLR, such as the Pacific Island Countries.

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List of Abbreviations

CC	Climate Change
CDM	Clean Development Mechanism
COP4	4th Conference of the Parties to the UNFCCC
EIA	Environmental Impact Assessment
ENSO	El Nino Southern Oscillation
GEF	Global Environmental Facility
GHG	Greenhouse Gas
PIC	Pacific Island Country
PICCAP	Pacific Island Climate Change Assistance Programme
SLR	Sea Level Rise
SPREP	South Pacific Regional Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
V&A	Vulnerability and Adaptation Assessment

Glossary of Terms

Adaptation refers to those actions or activities that people, individually or in groups, take in order to accommodate, cope with or benefit from the effects of climate change. People are continually adapting to their environment and its variability. Adaptation to climate change therefore may be defined as the component of additional environmental adaptation that is necessary in order to take climate change effects into account.

Anthropogenic climate change refers to change in the climate system that is attributable to human activities as opposed to natural trends and variability.

Clean Development Mechanism (CDM) refers to a flexibility mechanism established by the Kyoto Protocol. Its main purpose is to enable developed countries to obtain emissions reduction credits through financing development projects in developing countries that will contribute to reduced greenhouse gas emissions. The mechanism also, however, has a component of funds targeted for adaptation projects in particularly vulnerable countries.

An effect is a change in human-environment relationships that arises, or will arise, from climate change. The term is a neutral one. It does not imply magnitude or direction of change.

Environmental Impact Assessment (EIA) is a systematic method of analysis of the effects of a development on the social and biophysical environment. Used in development planning and in project appraisal, it is a useful tool providing information for decision makers.

An impact is an effect to which people have difficulty adapting. From this perspective an impact may be described as a high cost adaptation.

Proposal in the context of this document refers to either a proposed policy, programme, plan or project.

Sensitivity refers to the degree to which climate change effects bring about change (positive or negative) within an entity that is exposed to climate change or its effects.

Vulnerability and Adaptation (V&A) Assessment is a study which analyses to what extent a country (or sector or region, etc.) is vulnerable to the effects of climate change and identifies and evaluates adaptation options.

Vulnerability refers to the inability of an individual or group to adapt. Thus it does not simply refer to exposure to an effect, nor does it refer to sensitivity; however, given exposure and sensitivity, it refers to the inability to respond. An important element of vulnerability is the qualities of the vulnerable individual or group that may hinder its ability to adapt.

1. Introduction

There has been growing concern about the effects of human activities on the global environment. One of the main areas of concern is the growing concentration of greenhouse gases in the atmosphere.

There is consensus among the majority of climate scientists that "the balance of evidence suggests a discernible human influence on the global climate" (Intergovernmental Panel on Climate Change, 1995). These scientists also predict that the global climate will continue to change in the future and that sea levels will rise.

The United Nations Framework Convention on Climate Change (UNFCCC) was agreed upon in 1992. Its main objectives are as follows:

> *"to achieve, in accordance with the relevant provisions of the Convention, stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."*

By the end of 1998, thirteen Pacific Island Countries had ratified the Convention. The Kyoto Protocol to the Convention was agreed upon by the Parties to the Convention in 1997.

A key feature of the UNFCCC and the Kyoto Protocol is the provision of flexibility in enabling developed countries to meet their requirements for reducing emissions of greenhouse gases. These include a financial mechanism, known as the Clean Development Mechanism (CDM), that will enable developed countries to offset reduction targets through contributing to development projects that will bring about reduced greenhouse gas emissions in developing countries.

A portion of the proceeds generated by the CDM will be made available for funding adaptation activities in those developing countries that are particularly vulnerable to the adverse effects of climate change. The Convention identifies small island countries as being among the most vulnerable to such effects.

Adaptation, especially in those countries particularly vulnerable to the adverse effects of climate change, was also given priority at the 4th Conference of the Parties (COP4) to the UNFCCC held in Buenos Aires in November 1998.

It is likely that considerable financial resources will become available through the CDM for adaptation in Pacific Island Countries.

2. Why is Climate Changing?

The Natural Greenhouse Effect

Energy from the sun travels through space and reaches the earth as short wave radiation which includes visible light. Short wave radiation warms the earth's surface and is re-emitted as long wave radiation from the earth to space. Greenhouse gases in the atmosphere, including carbon dioxide, water vapour and a variety of trace gases, have the ability to absorb part of this long wave radiation while the remainder is lost to space. This ability of greenhouse gases to trap heat in the lower atmosphere is known as the natural greenhouse effect. The natural greenhouse effect helps maintain the average global temperature at 15°C and so is essential for life on earth.

The Enhanced Greenhouse Effect

Human activities, including the burning of fossil fuels and clearance of forests, have resulted in a significant increase in the levels of carbon dioxide and other greenhouse gases in the atmosphere. The increase in average global temperature resulting from this increase in greenhouse gases is known as the enhanced greenhouse effect.

3. Uncertainties of Climate Change

Although greenhouse gases and the enhanced greenhouse effect are expected to cause an overall rise in average global temperature, and with this a rise in sea level, there are many uncertainties involved in projecting the magnitude and exact nature of these changes:

- **Greenhouse gas emissions.** There is uncertainty in projecting the future rate of greenhouse gas emissions as this depends on a range of unpredictable factors such as global population growth, economic trends, technology trends and policy responses to climate change.

- **Climate sensitivity.** There is uncertainty in determining how much the climate will respond to a given amount of greenhouse gas increase.

- **Spatial distribution of climate changes.** There is uncertainty in deducing regional changes from projected changes in global averages.

Specific predictions of climate change for a region (such as the Pacific) are not possible. Scientists use scenarios of carbon dioxide emissions, models of global climate response to the enhanced greenhouse effect linked to models of regional climate patterns to develop a range of possible scenarios of climate change. These are known as climate change projections.

4. How will Climate Change in the Pacific?

There is much uncertainty as to how climate will change in the Pacific region. Climate science provides a range of projections which give an indication of possible future trends and changes in statistical averages.

- **Temperature.** All models show a warming of climate in the Pacific region. Using a 'middle-of-the-road' projection, average temperatures in the region are expected to increase by 1°C by the year 2050 and 1.5°C by the year 2100. Higher estimates project an increase of 1.5°C by 2050 and 3.0°C by 2100.
- **Sea level rise.** Mid-range estimates of sea level rise project an increase in sea level in the region of about 20cm by the year 2050 and 50cm by the year 2100, while high range estimates project a rise of 40cm by 2050 and 95cm by 2100.
- **Rainfall.** A significant problem in considering adaptation to climate change in the Pacific is that there is very little agreement between models on how rain fall may change in the region. While some models project moderate increases in rainfall of 5% and 15% for 2050 and 2100 respec-tively, other models project increases in excess of 50% and others decreases in the same order of magnitude. Regional patterns of change vary considerably between models.

Climate in the Pacific is characterised by a high variability attributed to climate phenomena such as El Niño/La Niña and extreme events such as tropical cyclones, droughts and floods. Climate science is not yet at a stage where it can provide projections of changes in climate variability and changes in the frequency and intensity of extreme events with any degree of accuracy.

Table 1. Increase in Mean Temperature in the Pacific

	2050	2100
Mid-range projections:	1°C	1.5°C
High projections:	1.5°C	3.0°C

Table 2. Sea Level Rise in the Pacific

	2050	2100
Mid-range projections:	20cm	50cm
High projections:	40cm	95cm

5. The Effects of Climate Change and Sea Level Rise

Projected changes in temperature, sea level and rainfall patterns are likely to have a profound effect in Pacific Island Countries. The range and magnitude of expected effects varies with the unique physical, ecological and socio-economic characteristics of each country.

National Vulnerability and Adaptation (V&A) assessments are used to determine the possible scope, nature and magnitude of the effects of climate change and sea level rise in a country. Some of the possible effects of climate change and sea level rise that are expected in Pacific island countries are noted in Table 3.

Table 3. An example list illustrating the wide range of possible effects of climate change and sea level rise in a selection of 'sectors' in Pacific Island Countries

Coastal zone	• Inundation and flooding of low-lying areas • Coastal erosion • Possible increase in cyclone related effects • Changes in sediment production due to changes in coral reef systems
Water resources	• Changes in freshwater lenses and other groundwater resources • Salt intrusion of groundwater resources • Changes in surface water resources • Changes in surface run-off, flooding and erosion
Agriculture	• Changes in commercial crop yields • Changes in subsistence crop yields • Changes in plant pest populations • Possible changes associated with changes in ENSO, drought and cyclone patterns • Changes in soil quality
Fisheries	• Changes in distribution and abundance of offshore fish species • Changes in productivity of inshore fisheries • Changes in fish breeding sites
Ecosystems	• Coral bleaching and coral degradation (also possible increased upward coral growth) • Changes in mangrove health and distribution • Degradation of sea grass meadows • Changes in forest ecosystems • Changes in wetland systems
Human health	• Increased incidence of vector borne diseases such as malaria and dengue fever • Increased heat stress and heat related illnesses • Indirect effects on nutrition and well-being secondary to effects in other sectors such as agriculture and water resources • Deaths, injuries and disease outbreaks related to possible increases in extreme events such as cyclones, floods and droughts

6. What is Adaptation?

Figure 1 shows the climate change process as a flow diagram. As the diagram indicates there are two main sets of responses to climate change: mitigation and adaptation.

Mitigation refers to those activities that seek to slow down the causes of the problem, mostly by reducing the rate of greenhouse gas emission.

Adaptation refers to those activities that people, individually or in groups such as households, villages, companies and various forms of government, carry out in order to accommodate, cope with, or reduce the adverse effects of climate change. In some cases adaptation can also include those activities that people undertake in order to benefit from the effects of climate change where possible.

It is important to remember that people are continually adapting to their environments. Adaptation to climate change includes those activities that take place over and above such normal environmental adaptation.

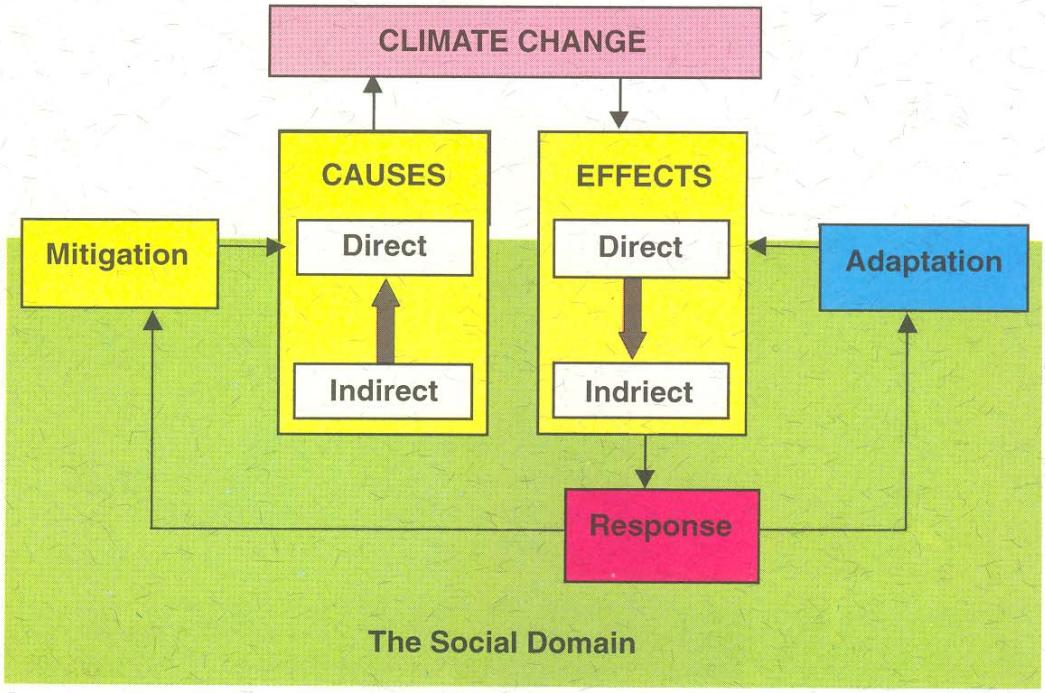

Figure 1. Diagram showing the cause–effect nature of the climate change problem. As the figure shows there are two types of response: mitigation and adaptation. Adaptation responses, the theme of this booklet, are those responses that help people to cope with the effects of climate change.

There are moves among the developed nations to reduce their emissions of greenhouse gases. Nevertheless, considering the previous high levels of greenhouse gas emissions and the likely rates of reduction in ongoing emissions, significant climate change is inevitable.

It is therefore very important that countries, especially those identified as being particularly vulnerable, begin to consider options for adapting to the effects of climate change.

There are many ways of classifying adaptation activities. One way is to distinguish those which are anticipatory and planned from those which are reactionary and forced (see Figure 2).

Anticipatory adaptations are those which are undertaken before the effects of climate change become obvious. They can be planned carefully with the luxury of time enabling economically efficient, socially appropriate and environmentally sound activities.

Reactive adaptations are those which take place only when climate change effects are experienced. In such cases the range of options is likely to be limited and adaptation may prove expensive, socially disruptive and environmentally unsustainable.

It would therefore be wise for Pacific Island Countries to consider policies for ensuring appropriate and timely adaptation to the effects of climate change by taking an anticipatory approach.

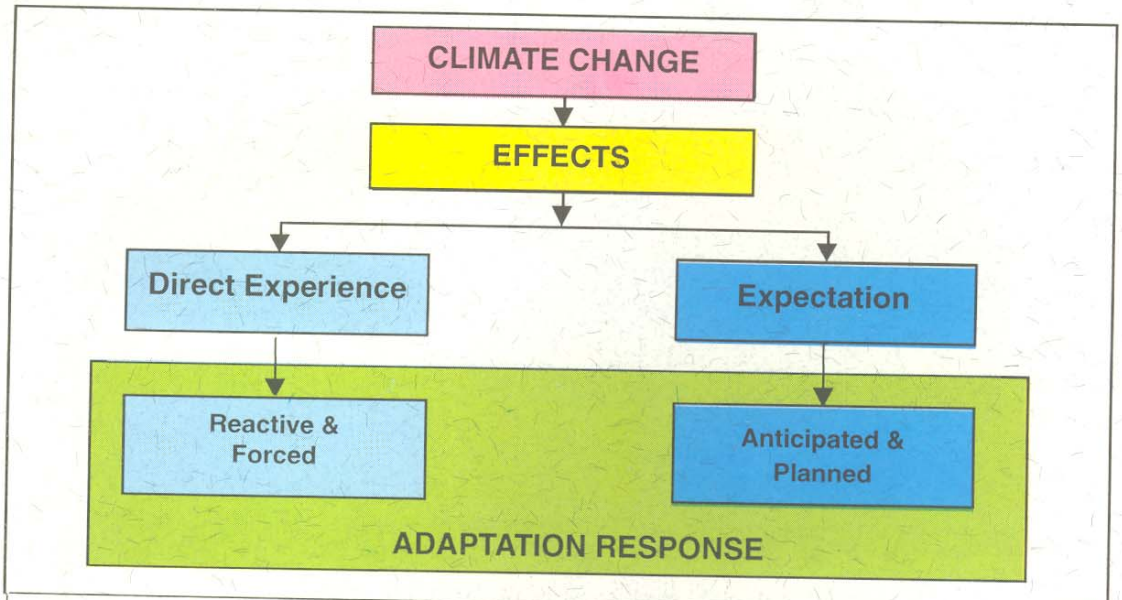

Figure 2. Reactive vs Anticipatory adaptation. Adaptations that are planned and initiated in advance of major adverse effects of climate change are more likely to be effective, cheaper and less disruptive than forced adaptations. In order to facilitate anticipatory adaptation the provision of information about likely effects and adaptation options is very important.

7. When should Anticipatory Adaptation Begin in the Pacific?

Figure 3 shows a projection of global sea level rise for a given emission scenario. Most projections of climate change and sea level rise show this typical increasing rate and magnitude of change represented by the steepening gradient of the curve. This emphasises that the opportunities for anticipatory adaptation will rapidly decrease as climate change effects continue to increase.

Pacific islands depend heavily (sometimes for their very existence) on valuable and important ecosystems which are sensitive to climate change—such as coral reef systems. Direct measures to optimise the health of these systems and their ability to cope with climate change will be most successful if they begin early while such ecosystems are relatively intact.

Many development plans, programmes and projects prepared today have a life expectancy that will require planners to evaluate them in terms of conditions in the future.

Adaptation involves preparing institutional capacity, developing expertise and building knowledge through research and monitoring. As these are relatively slow processes there should be no delay in their initiation.

Such anticipatory approaches will greatly reduce the potential cost of forced ad hoc adaptation responses at a later date when loss of resources and poorly planned development will limit the range of adaptation options available.

It is, therefore, important for Pacific Island Countries to implement anticipatory adaptation strategies as soon as possible.

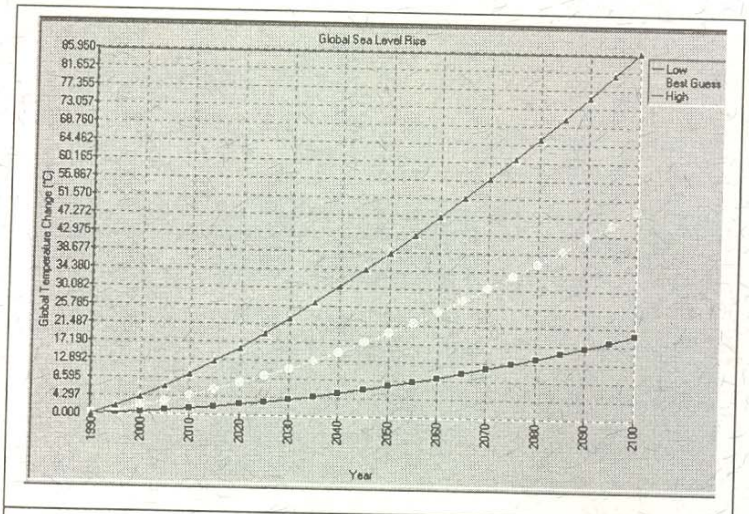

Figure 3. Projection of global mean sea level change based on IS92a emission scenario (1990–2100)

8. Who Adapts? The Role of Governments

People will adapt to climate change based on their understanding of the effects and options for response. The term used for such actions is autonomous adaptation.

The people who adapt may be individuals or members of groups such as households, extended families, clans, village or island councils, businesses or governments.

In many cases autonomous adaptations will be adequate and satisfactory. However, it is likely that there will be numerous cases where autonomous adaptation is not successful. The reasons are as follows:

- There may be limited or defective understanding of climate change effects;
- There may be limited or defective understanding of adaptation options;
- Adaptive actions taken by one group may not have benefits for others;
- The needs of future generations may not be accounted for;
- There may be cultural constraints to adaptation;
- Individuals or communities (or other groups or institutions) may not have adequate resources to undertake the most desirable adaptations; and
- It may be inefficient to implement certain types of adaptation at the level of the individual or community.

The role of governments is to facilitate the adaptation process to ensure that these obstacles are removed or reduced. In the context of Pacific Island Countries this would include:

- Providing information to decision makers, at all levels, about climate change, climate change effects and possible adaptive actions;
- Providing financial and other assistance to individuals and groups who have insufficient resources for effective responses;
- Ensuring that development policies, plans and projects take climate change effects intoaccount and incorporate appropriate adaptive responses; and
- Ensuring that adaptive responses are consistent with national social, economic and environmental development goals.

Governments must also take adaptive action where their own property, resources and services are adversely affected by climate change.

9. Incorporating Adaptation into Development

As development policies, programmes, plans and projects are future oriented it is important that any investments in development take into account the likely effects of climate change and incorporate adaptation as necessary.

This is especially the case in development projects that have a long-term life expectancy (e.g. port development, infrastructure, tourist hotels, tree crop plantations and forestry), that may stress a resource or ecosystem sensitive to climate change or have an effect on the ability of society to cope with climate change.

There are three types of proposals that can be considered in terms of adaptation and development.

- The first type includes those proposals in which the main objective is development. In these projects the adaptation component can be seen as additional, but necessary in order to ensure sustainability. Examples of these projects include the following:
  * Infrastructure development;
  * Housing programmes;
  * Agricultural development; and
  * Tourism development.

- The second type includes those proposals that are specifically adaptation oriented. Examples of these projects include the following:
  * Coastal protection;
  * Developing drought / salt resistant crops; and
  * Public awareness programmes on effects of climate change and on possible adaptive responses.

- The first type includes those proposals in which the main objective is development. In these projects the adaptation component can be seen as additional, but necessary in order to ensure sustainability. Examples of these projects include the following:
  * Infrastructure development;
  * Housing programmes;
  * Agricultural development; and
  * Tourism development.

- The second type includes those proposals that are specifically adaptation oriented. Examples of these projects include the following:
  * Coastal protection;
  * Developing drought / salt resistant crops; and
  * Public awareness programmes on effects of climate change and on possible adaptive responses.

- The third type of project includes capacity building for dealing with the likely effects of climate change. Examples of these projects include the following:
  * Institutional development; and
  * Human resource development including:
    - Climate science training;
    - Technical training for adaptation; and
    - Public awareness skills training.

10. A Comprehensive Anticipatory Adaptation Response

Based on these three project types, it is possible to consider a comprehensive anticipatory adaptation response in terms of three adaptation strategies (see Figure 4):

- Strategy 1: Incorporating climate change and sea level rise considerations into all new development proposals.
- Strategy 2: Developing proposals that are specifically aimed at addressing a possible effect of climate change and sea level rise.
- Strategy 3: Developing proposals that are aimed at building institutional and technical capacity to facilitate Strategies 1 and 2 and to manage the effects of climate change and sea level rise.

Incorporating adaptation into development could be achieved through the implementation of these three adaptation strategies.

Each of these strategies should be supported by adaptation funding.

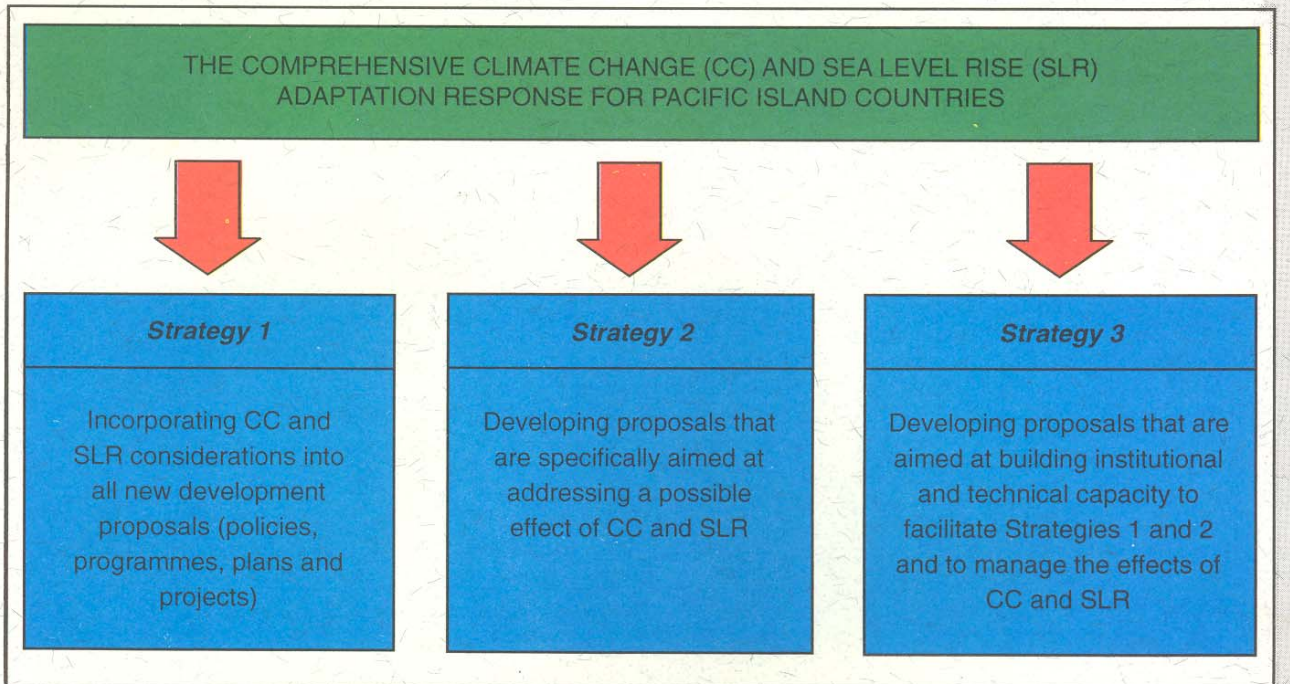

Figure 4. A comprehensive approach to anticipatory adaptation. Each of the three strategies represents an important component of adaptation and should be eligible for adaptation funding.

11. Implementation of Adaptation Strategies

Strategy 1 applies to those proposals considered as normal development. Adaptation considerations may be incorporated into these normal development proposals through the procedures of the CC and SLR adaptation process presented in Section 12.

Strategy 2 and 3 proposals concern a new type of project for which procedures of project identification and initiation do not yet exist. Therefore, new approaches and procedures should be developed in order to identify, develop and implement proposals under Strategies 2 and 3.

One possible approach is that countries appoint a Climate Change Co-ordinating Team drawn from senior politicians, and from public servants and technical experts from appropriate ministries and departments.

This team should report on an annual basis on adaptation needs and draw on information resources such as the National Climate Change Vulnerability and Adaptation (V&A) assessments and on local and regional expertise.

The report should include:

- An update on the state of climate change science as it relates to Pacific Island Countries;
- An update on the likely effects of climate change in Pacific Island Countries;
- A review of national adaptation needs; and
- Recommendations for Strategy 2 and Strategy 3 projects.

Strategy 2 and 3 proposals, as development proposals in their own right, should also then be submitted to the CC and SLR adaptation process presented in section 12.

12. The CC and SLR Adaptation Process

The CC and SLR adaptation process has been designed as a key tool to integrate CC and SLR adaptation into national development. (See Figure 5).

The process is not a prescriptive process, but as a recommended additional tool providing information for decision making, it can be integrated into existing planning, public participation and decision making protocols and procedures.

Step 1 is the starting point for either a normal development proposal (Strategy 1) or an adaptation proposal (Strategy 2 and 3).

Steps 2–7 are the key steps used for analysing the proposal in terms of climate change and modifying it to incorporate adaptation considerations. These steps may be repeated until an acceptable outcome is obtained. (The scale and scope of analysis should be proportional to the scale of the proposal.)

- **Step 2** is an analysis of the effects of CC and SLR on the proposal itself in order to determine if modifications are necessary.
- **Step 3** is an analysis of the effects of the proposal on key ecosystems, resources and environments which are sensitive to CC and SLR in order to determine if modifications are necessary.
- **Step 4** is an analysis of the effects of the proposal on the ability of communities to cope with the effects of CC and SLR in order to determine if modifications are necessary.
- **Step 5** requires the generation of proposal modification options in response to the findings of the three analysis steps.
- **Step 6** is an evaluation of these modification options.
- **Step 7** requires the integration of appropriate modification options into a revised proposal which thus incorporates CC and SLR adaptation considerations.
- **Step 8** is intended to provide an indication of the amount of funding the proposal may attract from international adaptation funds (such as the CDM) when such funds become available.
- **Steps 9–11** are steps common to most planning pathways and involve providing information to decision makers, proposal approval and implementation. international adaptation funds (such as the CDM) when such funds become available

Additional step-by-step guideline notes and information tables to assist the implementation of this process are provided in Annexes I and II.

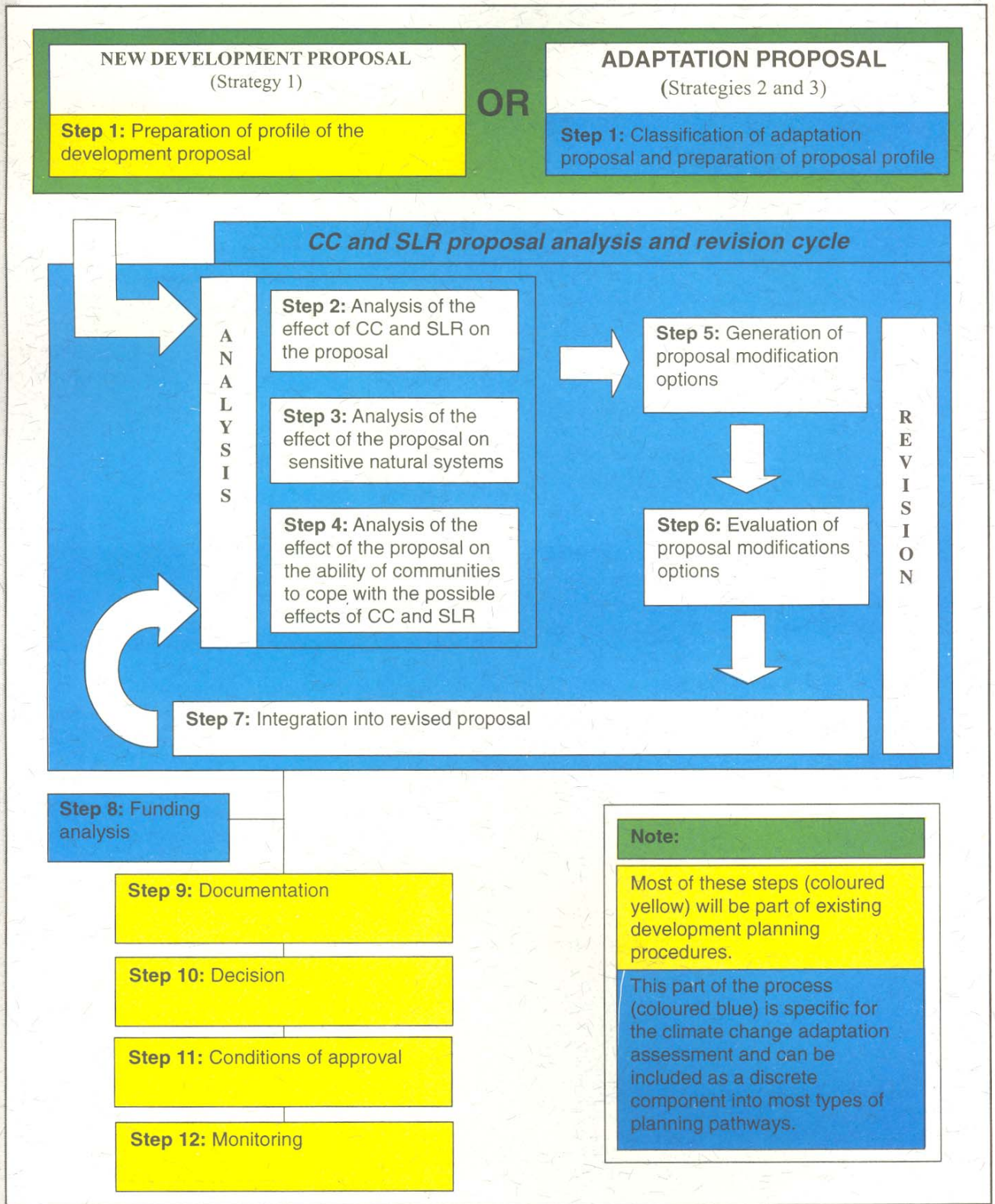

Figure 5. Flow chart of the CC and SLR adaptation process.

13. The Clean Development Mechanism

The parties to the UNFCCC and the Kyoto Protocol have identified small island states as being among those countries that are particularly vulnerable to the adverse effects of climate change.

As part of the flexibility mechanisms for encouraging nations to reduce the emissions of greenhouse gases the Clean Development Mechanism (CDM) has been established under the Kyoto Protocol.

The purpose of the CDM is to enable developed countries to obtain credits for reducing emissions of greenhouse gases by financing certified development project activities in developing countries that contribute to reduced greenhouse gas emissions.

Article 12, Paragraph 8 of the Kyoto Protocol states that "a share of the proceeds from certified project activities [will be] used ... to assist developing country Parties that are particularly vulnerable to the adverse effects of climate change to meet the costs of adaptation."

It is anticipated that the CDM will generate large sums of financial resources for adaptation projects in Pacific Island Countries.

The financial mechanism for supporting the implementation of the Kyoto protocol is the Global Environmental Facility (GEF). However the modalities for implementing the CDM are at this stage unclear.

14. The Allocation of International Adaptation Funds

At present, there are no official or draft guidelines determining how adaptation funds (such as CDM funds and adaptation funds from other donors) will be allocated and approved for projects in vulnerable countries.

Funding for adaptation is likely to be made available only for those activities or actions that are 'incremental', or over and above what would normally be expected if adaptation were not necessary.

In terms of the three strategies presented in these guidelines, adaptation funding for Strategies 2 and 3 is, therefore, likely to be straightforward. Proposals that are Strategy 2 or 3 proposals should be eligible for a high level of support from such adaptation funds.

Funding for Strategy 1 proposals may only apply to the 'incremental' modifications applied over and above the 'original' project. There is still much uncertainty as to what will constitute 'incremental' costs.

Lastly, costs incurred through the implementation of the CC and SLR adaptation process may be offset with adaptation funding.

Annex I: Step-by-Step Guide to the Climate Change and Sea Level Rise Adaptation Process

When should this process be used?

Ideally, all new development proposals (policies, plans, programmes and projects) should be subject to this process. The process is designed in such a way that it can be applied to any type of development activity and to any scale of development initiative. Similarly, proposals developed specifically for adaptation may also be submitted to this process for evaluation and modification.

What is the purpose of submitting proposals to this process?

The overall aim of the process is that it will assist:

- Proposal evaluators to ask the correct questions of any development proposal in terms of adaptation to Climate Change and Sea Level Rise (CC and SLR);
- Decision makers to make development decisions which are fully cognisant of adaptation to CC and SLR; and
- The development, evaluation and improvement of proposals where the primary aim is adaptation.

How does the process work?

The process has been designed as a generic process that may be integrated into other project development and evaluation procedures such as policy analysis and environmental impact assessment. It is, therefore, a supplementary proposal evaluation tool for the purposes of CC and SLR assessment and is not intended to replace, but rather to rely on, existing procedure such as Environmental Impact Assessment (EIA). The CC and SLR proposal analysis and revision cycle (highlighted in blue in Figure 5) is the key CC and SLR planning process while other steps (highlighted in yellow in Figure 5) may already exist in planning procedures.

The process is not prescriptive

The process is not prescriptive and does not advocate specific measures or technologies or support specific regulations, but rather enables the relevant CC and SLR adaptation questions to be asked of a development proposal and the appropriate evaluation of adaptation proposals. It is not intended to impose a preconceived notion of how a country should plan development or adapt to CC and SLR, but rather provides a framework for directing the collection of relevant information that may be used at the discretion of the decision maker.

Public participation

The process steps do not specifically include public participation, as procedures and modalities for public participation vary greatly between countries and are assumed to be integral to the existing planning framework. All adaptation proposals and development proposal modifications would, therefore, make use of existing public participation protocols and methods.

The starting point

The CC and SLR adaptation process should be useful for the following:

- **New development proposals** This type of proposal may be considered part of normal development. It is submitted to this process so that it may be evaluated and modified in terms of CC and SLR adaptation concerns. Step 1 is shown in yellow. The following steps in the process are identical to the adaptation proposal (Strategies 2 and 3) and are shown in blue.
- **Adaptation proposals** This is a proposal in which the primary aim is adaptation to CC and SLR or the facilitation of adaptation to CC and SLR. The steps in this process are shown in blue.

NEW DEVELOPMENT PROPOSAL

(Adaptation Strategy 1)

Step 1: Preparation of development proposal profile	
Objective:	To develop full understanding of all aspects of the proposal and all activities implicit in the proposal in order to undertake further analysis of these in terms of CC and SLR.
Key tasks:	Identify all physical aspects of the proposal such as: • Site location; • Resources to be used by proposal; • Technologies; • Design features; • Materials; and • Design life expectancy Identify all physical activities of the proposal which have environmental effects. Where applicable, consider these in all project phases (e.g. construction, operation, decommissioning).
Note:	Much of this step may have been completed through non-climate planning procedures.

ADAPTATION PROPOSAL

(Adaptation Strategies 2 and 3)

Step 1: Classification of adaptation proposal and preparation of profile	
Note:	The identification and initiation of appropriate adaptation proposals would be undertaken by the proposed Climate Change Co-ordinating Team or similar body.
Objective:	To confirm classification of proposal as Strategy 2 or 3 adaptation. To develop full understanding of all aspects of the proposal and all activities implicit in the proposal in order to undertake further analysis of these in terms of CC and SLR.
Key tasks	Explain why the proposal should be considered as a Strategy 2 or Strategy 3 adaptation response. Identify all physical aspects of the proposal such as: • Site location; • Resources to be used by proposal; • Technologies; • Design features; • Materials; and • Design life expectancy. Identify all physical activities of the proposal which have environmental effects. Where applicable, consider these in all project phases (e.g. construction, operation, decommissioning).

Step 2: Analysis of the effect of CC and SLR on the proposal	
Process context:	First of the three analysis phases.
Objective:	The proposal may need to be modified so that its design is fully cognisant of CC and SLR.
Rationale:	To analyse how the proposal itself may be affected by CC and SLR.
Key questions to aid analysis:	Is the design length of the proposal such that it should be cognisant of future climate and sea level conditions? (Table1) As an indicator (or analogue) of future risk, is the proposal likely to be affected by present climate variability and extremes in sea level? (Table 2) Which factors of climate change may affect the proposal within its life span? (Table 1) How may these factors directly affect the proposal? Does the proposal depend on or involve natural resources or ecosystems that are sensitive to CC and SLR? (Table 3) Does the proposal depend on or derive benefit from ecosystems that are sensitive to CC and SLR? (Table 3) Will the proposal be subject to the effects of climate change within specific socio-economic sectors? (Table 5)

Step 3: Analysis of the effect of the proposal on sensitive natural systems	
Process context:	Second of the three analysis phases.
Objective:	To analyse how the proposal will impact valuable ecosystems and resources which are sensitive to CC and SLR.
Rationale:	Minimising the impact of the proposal (and other stress factors) on those important ecosystems (e.g. coral reefs) and natural resources (e.g. freshwater lens) which are sensitive to CC and SLR (i.e. will be stressed by CC and SLR) will increase their ability to adapt and thus maintain or increase future resource options.
Key questions to aid analysis:	Will any aspects or activities of any phase of the proposal have a direct effect on a sensitive natural system? (Tables 3&4) Will any aspects or activities of the proposal have an indirect effect on a sensitive natural system? (Tables 3&4) Will any aspects or activities of the proposal stress a sensitive resource? (Tables 3&4) Will the proposal discourage or decrease existing activities which stress a sensitive natural system or resource? (Tables 3&4)

Step 4: Analysis of the effect of the proposal on the ability of communities to cope with the possible effects of CC and SLR	
Process context:	Third of the three analysis phases.
Objective:	To analyse how the proposal may influence the ability of communities to cope with the effects of CC and SLR.
Rationale:	Traditional practices and institutions, cultural practices, environmental characteristics and socio-economic conditions, affect the degree to which communities are affected by, and able to cope with, environmental stresses including climatic variability and extremes.
Key questions to aid analysis:	Will the proposal exacerbate or ameliorate the direct effects of climate change and SLR within specific socio-economic sectors? (Table 5) Will the proposal influence the ability of communities to cope with these effects? Will the proposal change socio-economic and environmental factors that increase the ability of communities to cope with climatic and environmental stress? (Table 6) Will the proposal change socio-economic and environmental factors that decrease the ability of communities to cope with climatic and environmental stress? (Table 7)

Step 5: Generation of proposal modification options	
Process context:	First phase in proposal revision.
Objective:	Based on each of the three analysis phases, to develop options for modification of the proposal so that it incorporates these CC and SLR considerations.
Rationale:	Modification options will be measures that allow the proposal to: • Be less likely to be detrimentally affected by present climate variability and extremes as well as future CC and SLR; • Minimise stresses and negative effects on sensitive systems and resources and maximise positive effects on sensitive systems; and • Reduce the need for, and increase the ability of, communities to cope with the effects of CC and SLR.
Key points	In response to the findings of each analysis step, and considering all aspects and all activities of the proposal, generate modification options through considering: 1. Alternatives in: • Design • Materials • Timing • Location • Technology 2. Mitigation of negative effects; and 3. Enhancement of positive effects.

Step 6: Evaluation of proposal modifications options	
Process context:	Second phase in proposal revision.
Objective:	To evaluate modifications to ensure that the modification options themselves are appropriate and are carefully analysed in terms of CC and SLR assessment.
Rationale:	Modifications are evaluated against a range of criteria which also include CC and SLR considerations.
Key criteria:	Key criteria suitable for evaluating adaptation measures and proposal modifications are listed in Table 8.

Step 7: Integration into revised proposal	
Process context:	Third phase in proposal revision.
Objective:	To integrate appropriate CC and SLR modifications into a revised proposal.
Rationale:	Modifications are evaluated against a range of criteria which also include CC and SLR considerations.
Note:	It is important that the revised proposal is re-submitted through the cycle until the most favourable outcome is obtained. From this perspective it is clear that in practice this process will not be a strictly sequential step-by-step cycle, but merely represents the steps and criteria that ultimately must be fulfilled by the proposal.

Step 8: Funding analysis	
Process context:	Undertaken after proposal details and modifications are evaluated, reviewed and finalised.
Objective:	To determine to what extent the proposal may be supported by international funds dedicated to climate change adaptation assistance.
Rationale:	• Proposals which are Strategy 2 or 3 proposals would warrant a high level of support from adaptation funds. • Modifications to Strategy 1 proposals would warrant support from adaptation funds as may elements of the proposal with inherent CC and SLR benefit. • Furthermore, costs incurred through the implementation of this process may be offset with adaptation funding.
Key questions to aid analysis:	Is this proposal considered a Strategy 1, 2 or 3 proposal? What are the additional costs incurred by modifications to the proposal as the result of this process? What were the costs incurred by additional studies undertaken to facilitate the above analyses? Which aspects of the proposal confer a positive benefit in terms of adaptation to CC and SLR?
Note:	**Funding agencies may require a specific format for the presentation of information and the funding application.**

Step 9: Documentation of analysis and modification responses	
Process context:	This may be presented as a separate CC and SLR adaptation assessment or as a specialist component study within existing proposal documentation requirements.
Objective:	To record key findings from steps 1–8.
Rationale:	Provision of appropriate information to decision makers and adaptation funding sources.

Step 10: Decision	
Process context:	Integrated into existing decision making procedures and protocols as a component consideration.
Objective:	A decision which, as well as taking other environmental and development factors into account, also considers CC and SLR factors of relevance to the proposal's implementation.
Rationale:	Full consideration of: • the effect of present climate variability and extremes and also future CC and SLR on the proposal; • the effect of the proposal on CC and SLR sensitive natural systems and resources; • the effect of the proposal on the need for, and the ability of, communities to cope with environmental and in particular climatic stress; and • the adaptation merit of the proposal.

Step 11: Conditions of approval	
Process context:	Implementation of proposal
Objective:	To implement, if necessary, appropriate environmental management plans and monitoring procedures.
Rationale:	Analysis of the proposal may have suggested that certain key requirements and certain ongoing management measures are necessary to achieve the optimal outcome in terms of CC and SLR considerations.

Step 12: Monitoring	
Process context:	Implementation.
Objective:	To ensure the proposal meets criteria required of its implementation.
Rationale:	Monitoring of key parameters as may have been identified in analysis and revision steps.

Annex II: Process Information Tables

Note: The following set of tables are a supplement to the notes presented in Annex I. The lists presented are intended as example lists and are not exhaustive or definitive.

The lists have been drafted to be of general value in the Pacific region with consideration given to typical environmental and socio-economic characteristics. Consequently they are prone to generalisation and assumption and should be interpreted with special consideration given to the local circumstances and conditions.

Table 1: Components of CC and SLR

For temperature increase and sea level rise, climate science provides useful projections of possible change.

Increase in mean temperature expected in Pacific region

Year:	2050	2100
Mid-range projections:	1°C	1.5°C
High projections:	1.5°C	3.0°C

Global Sea Level Rise

Year:	2050	2100
Mid-range projections:	20cm	50cm
High projections:	40cm	95cm

For climate variability and components of climate other than temperature, scientific projections are not yet reliable and planning needs to take into account a wider range of possibilities by posing a range of 'What if?' questions (e.g. *'What if rainfall decreases?' 'What if cyclone events increase in frequency and intensity?'*)

Rainfall changes	Climate models are unable to project with any degree of confidence if rainfall will increase or decrease and the magnitude of this increase or decrease for any region in the Pacific.
Cyclones	Increase in intensity and frequency is possible but as yet no sound scientific evidence in support of this exists.
ENSO patterns	Climate change science does not yet provide useful information on how the ENSO phenomenon may be affected by the enhanced greenhouse effect.

Table 2: Using present climate variability and extremes as analogues of future conditions	
Climate variability phenomenon	**Relevance**
ENSO	• Analogue of future low rainfall conditions or high rainfall conditions • Analogue of changed temperature conditions • Analogue of possible changes in future Sea Surface Temperature (SST)
Cyclones	• Possible increased cyclone frequency and intensity in future • Analogue of flood events • Analogue of inundation events (sea surge)
Droughts	Analogue of future low rainfall conditions

Table 3: List of key sensitive ecosystems, natural resources and environments

Definition: A sensitive ecosystem, natural resource or environment is one that will be directly affected by an element of CC and/or SLR.

- Coral reefs
- Dynamic shorelines
- Estuaries
- Freshwater lenses
- Groundwater systems
- Lagoons
- Mangroves
- Salt marshes
- Sandy shorelines
- Sea grass meadows
- Sedimentary shorelines
- Soils
- Water catchment areas
- Wetlands

Table 4: Activities and non-climatic factors which may directly or indirectly stress, diminish or degrade sensitive ecosystems and natural resources – an example list		
System or resource	**Activities, factors and stresses**	
Coral reefs	Sediment loading Solid waste pollution Coral mining Overexploitation Freshwater loading Thermal discharges Exotic species introduction Nutrient loading Sewage outflow Sewage run-off Fertiliser run-off Destructive fishing practices	Pesticide pollution Petrochemical pollution Heavy metal pollution Leachate from solid waste Other chemical pollution Litter Current modification Construction activities Dredging Blasting Loss of biodiversity
Dynamic shorelines **Sandy shorelines** **Sedimentary shorelines**	Constructions modifying current regimes / sediment transport: • Sea walls • Wharves • Quays • Causeways • Harbours • Reef channels • Other construction activities	Sand mining Aggregate removal Vegetation loss
Estuaries **Lagoons**	Current modification Overexploitation Chemical pollution Sewage pollution	Nutrient pollution Land reclamation Loss of biodiversiy
Freshwater lenses **Groundwater systems**	Sewage pollution / contamination Chemical pollution Water abstraction	Factors which decrease recharge capacity
Mangroves **Salt marshes** **Sea grass beds**	Reclamation Chemical pollution Nutrient pollution	Solid waste pollution Loss of biodiversity
Soils	Poor soil management practices Deforestation De-vegetation	Soil erosion
Water catchment areas	Deforestation Poor agricultural practices De-vegetation	Chemical pollution Sewage pollution Factors modifying run-off co-efficient
Other wetlands	Reclamation Sewage pollution / contamination Chemical pollution	Solid waste pollution Loss of biodiversity

Table 5: Specific adaptation measures based on possible direct impacts in key socio-economic sectors		
Sector	**Impacts**	**Measures / considerations**
Water	**Water shortages** (lower rainfall averages, longer and more intense droughts, groundwater salt intrusion)	**Increase / improve supply:** Groundwater protection (cf. Tables 3&4) Increase water storage facilities Rainwater catchment Desalination Water catchment protection (cf. Tables 3&4) **Decrease demand:** Water conservation measures Leakage reduction Duel water supply systems Type of economic development
	Flooding (from run-off) (higher average rainfall, more tropical storms and cyclones)	Watershed protection Watershed management Positioning of infrastructure and buildings Design of infrastructure and buildings Protection of infrastructure and buildings
Health	**Increase in vector borne disease risk (dengue fever and malaria)** (raised average temperature)	**Decrease mosquito breeding sites:** Decrease artificial breeding sites (litter, solid waste, other potential containers) Cover water containers **Prevent entry of mosquitoes:** Port controls Quarantine regulations **Prevent exposure:** House design Mosquito nets
	Heat stress / comfort (higher temperatures)	Building design / materials Traditional building styles Shade trees
	Disease outbreaks (floods, cyclones)	Optimise sanitation infrastructure design Disaster preparedness Town planning / land use planning
Coastal hazards	**Inundation and flooding**	Coastal protection (cf. Tables 3&4) Positioning of infrastructure and buildings Design of infrastructure and buildings Protection of infrastructure and buildings
	Coastal erosion	Coastal protection (cf. Tables 3&4) Coastal vegetation Beach nourishment

Table 5 (continued)

Sector	Impacts	Measures / considerations
Agriculture	Decreased crop yields due to low rainfall / pest outbreaks	Drought resistant varieties Change crop types
	Decreased crop yields due to salt intrusion (e.g. taro)	Diversify crops Maintain subsistence sector Avoid monoculture strategies
	Storm damage	Salt resistant crop varieties Maintain subsistence sector Crop diversity

Table 6: General socio-economic and environmental factors which may enhance the ability of communities to cope with climatic and environmental stresses (present and future) – an example list	
Traditional and cultural practices	• Reciprocity • Gift giving • Extended family ties • Strong local government • Subsistence agriculture / home gardening • Forest resources / disaster foods • Traditional knowledge and experience • Traditional housing styles
Development factors	• Good transport infrastructure • Good communication infrastructure • Good sanitation infrastructure • Good standard of living • Good education system • Adequate health facilities and services • Effective emergency services • Disaster management and preparedness
Economic factors	• Diverse economy • Diverse agricultural base • Sustainable resource use • Resource diversity • Financial mechanisms to spread loss (e.g. insurance, disaster funds, community trust funds)
Institutional factors	• Effective and efficient government • Technical capacities • Expertise • Disaster management capacity • Strong community groups • Community services • NGOs
Environmental factors	• Productive ecosystems • Robust ecosystems • Resource protection • Sustainable resource use • Resource diversity • Traditional resource conservation and management practices

Table 7: General socio-economic factors which decrease the ability of communities to cope with climatic and environmental stresses (present and future) – an example list	
Traditional and culture	• Loss of traditional knowledge • Loss of traditional disaster coping strategies • Breakdown of extended family ties
Development factors	• Deficient transport infrastructure • Deficient communication infrastructure • Informal settlements • Overcrowding • Sub-standard living conditions • Low education standards • Deficient health facilities and services • Deficient emergency services • Deficient or lacking disaster management • Inappropriate building materials and styles
Economic factors	• Narrow economic base • Narrow agricultural base • Overexploitation of resources • Loss of resources
Environmental factors	• Degraded ecosystems • Degraded resources • Overexploitation of resources • Loss of diversity of resource base
Institutional factors	• Lack of expertise • Lack of technical capacity

Table 8: Evaluation criteria – a recommended list	
Economic efficiency and economic sustainability	Costs of adaptation measures and proposal modifications should be proportional to / appropriate for the benefits gained by implementation. This would not only relate to initial costs (which may often be covered by a donor) but to ongoing maintenance costs.
Sustainability	Adaptation measures and proposal modifications should not only be economically sustainable as described above, but also sustainable in terms of local expertise and skills to maintain the project and continue reaping benefits. Sustainability also refers to environmental and social sustainability in that adaptation projects should not cause or exacerbate existing environmental (and social) problems.
Aesthetics	The natural environment and the aesthetics of the islands are important and provide amenity and commercial value. Adaptation measures and proposal modifications should be aesthetically acceptable.
Compatibility with national development strategies	Adaptation measures and proposal modifications should be compatible with national development strategies, and where possible contribute to the overall economic and social development of the islands.
Environmental benefits	Environmental and ecological integrity are of paramount importance in PICs. Any adaptation project should promote environmental protection and not result in adverse environmental impacts or disruption of natural systems.
Equity and fairness	The costs of adaptation measures and proposal modifications (monetary and non-monetary) should be fairly distributed across communities, groupings and sectors. Compensation mechanisms may need to be considered.
Intergenerational equity	Adaptation measures and proposal modifications should generate benefits for future generations and not incur disproportionate costs for future generations.
Cultural acceptability	Adaptation measures and proposal modifications need to be culturally acceptable and appropriate.
Public participation	Adaptation measures and proposal modifications should be evaluated in terms of the degree to which the public has been able to participate in their development.

Annex III: Climate Change Contacts and Information Sources in the Pacific

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