Discussion Paper

Pacific Adaptation to Climate Change:

Past Approaches and Considerations for the Future

Prepared by

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for

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Executive Summary

As a result of over two decades of vulnerability assessments, the Pacific islands region is considered to be one of the regions most at risk to the adverse consequences of climate change. Pacific island countries have shown strong leadership in characterising the challenges of climate change, both nationally and for the region as a whole, and in identifying the most appropriate responses.

This discussion paper reviews the various vulnerability and adaptation assessment methods that have been used across the Pacific islands region, with an emphasis on the past two decades. The aim is to identify the approaches that are best suited to the region, and to develop common understanding and principles that may be relevant and useful to harmonising understanding of vulnerability across the region.

The paper identifies and assesses the approaches, methods and tools that have merit for further use, without or with further improvements. Lessons learned as well as success stories and success factors are documented. These findings are reflected in principles designed to assist harmonisation of approaches to vulnerability assessment and adaptation. These principles, in turn, influence preparation of a proposed higher-level framework for vulnerability and adaptation assessments. It accommodates the various approaches, methods and tools commonly used with success in the Pacific.

Two assessment approaches have been identified as being "best suited to the Pacific region", namely vulnerability- and risk-focused assessments. Both conform to the principles that the present study has developed. The associated methods and tools have a history of successful use globally. They have also evolved to better suit regional circumstances. There is a rapidly growing capacity at regional, national and community levels to apply these approaches.

However, there remains considerable room for further improvement. There is an increasing gap between the information currently available and that needed to undertake state-of-the-art assessments that would ensure policy-makers and planners can make well-informed, climate-related decisions. Also, while the Pacific has benefited from over 20 years of assessment experience, few lessons learned have been adequately documented and communicated. As a result there are all too few examples of lessons learned being put into practice. Strengthening the monitoring, evaluation and reporting of adaptation initiatives can help address this issue. This should include initiatives related to disaster risk reduction. Documenting instances of mal-adaptation would also help address this gap.

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Abbreviations

APF	Adaptation Policy Framework
C-bA	Cost-benefit Analysis
CBA	Community-based Adaptation
CBDAMPIC	Capacity Building for the Development of Adaptation Measures in Pacific Island Countries
CBDRM	Community-based Disaster Risk Management
CBO	Community-based Organisation
CHARM	Comprehensive Hazard Assessment and Risk Management
CRiSTAL	Community-based Risk Screening – Adaptation and Livelihoods
CRP	Climate Risk Profile
CV&A	Community Vulnerability and Adaptation Assessment and Action Methodology
CWT	Climate Witness Toolkit
EBA	Ecosystem-based Adaptation
EVI	Environmental Vulnerability Index
GEF	Global Environment Facility
GSA	Gender-sensitive Approach
G-V&A	Vulnerability and Adaptation Assessment Guidelines
IAAM	Integrated Assessment and Action Methodology
IAM	Integrated Assessment Model
IFRCS	International Federation of Red Cross/Red Crescent Societies
IPCC	Intergovernmental Panel on Climate Change
LDC	Least Developed Country
LLRM	Local Level Risk Management
NAPA	National Adaptation Programme of Action
NCSA	National Capacity Self Assessment
NGO	Non-governmental Organisation
NSA	National Scoping Assessment
NWP	Nairobi Work Programme
PACC	Pacific Adaptation to Climate Change (Project)
PASAP	Pacific Adaptation Strategy Assistance Programme
PIC	Pacific Island Country
PIFACC	Pacific Islands Framework for Action on Climate Change
PDRRDMFA	Pacific Disaster Risk Reduction and Disaster Management Framework for Action
RAA	Risk Assessment Approach
RBA	Risk-based Adaptation
RFA	Risk Financing Assessment
SAA	Sectoral Assessment Approach
SDA	Scenario-driven Approach
SI	Susceptibility Index
SPA	Strategic Priority on Adaptation
SRM	Stress-Response Methodology
TNA	Technology Needs Assessment
UNFCCC	United Nations Framework Convention Climate Change
UNDP	United Nations Development Programme
USD	United States Dollar
VCA	Vulnerability and Capacity Assessment
VRA	Vulnerability Reduction Assessment
V&A	Vulnerability and Adaptation

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1. Introduction

The Pacific islands region is one of the regions most at risk to the adverse consequences of climate change (IPCC, 2007). This understanding is the result of over two decades of assessments and other studies that have utilised a variety of methods and tools to determine the potential impacts of climate change, the resulting vulnerabilities, the resilience and adaptive capacity of natural and human systems to climate change, and possible and prioritised adaptation interventions. The special nature of the islands and their ocean surrounds have inspired the development of innovative methods and tools, as well as pioneering efforts to use the findings to inform policy making, planning, resource mobilization and actions on the ground (Nunn, 2009). Despite these efforts, Pacific island countries (PICs) have yet to see appreciable benefits in terms of reductions in the climate-related risks and vulnerabilities they face (Barnett and Campbell, 2010). With climate risks increasing in the Pacific (Hay and Mimura, 2010), as well as globally (American Meteorological Society, 2010), there is a need for an even greater but smarter effort, at all levels, to address climate change.

This discussion paper reviews the various vulnerability and adaptation (V&A) methods that have been used across the Pacific islands region, with an emphasis on the past two decades. The aim is to identify the approaches that are best suited to the region and to develop principles and/or common understanding that may be relevant and useful to harmonise understanding of vulnerability across the region. Thus, overall, the paper identifies and assesses the approaches used in the region that have merit for further use, with or without further improvements. The methods used, and sources of information, are described in Figure 1 and elaborated in Annex 1.

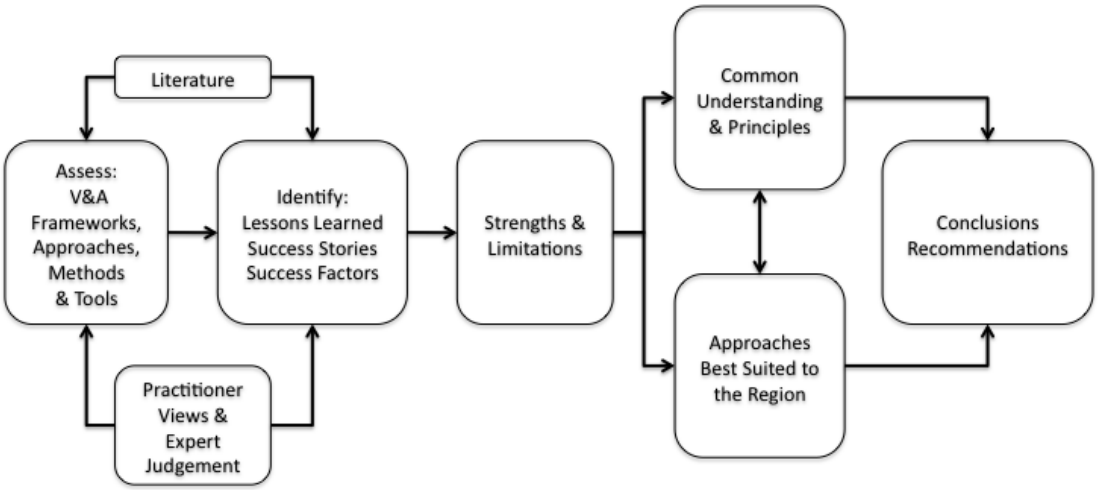

Figure 1. Study methods and sources of information.

The discussion paper will be an input to a regional workshop to be held in 2011 to discuss a number of issues arising out of a regional overview currently being prepared by Australia's Pacific Adaptation Strategy Assistance Programme (PASAP). The overview will describe regional trends in climate change impacts, vulnerability and adaptive capacity. It is one activity of PASAP, which overall is designed to help strengthen partner country capacity to assess vulnerability to climate change and develop evidence-based adaptation strategies.

2. Vulnerability and Adaptation Assessment in the Pacific Region

Figure 2 summarises the history of frameworks, approaches, methods and tools related to V&A assessments undertaken in the Pacific, based on the more detailed analysis presented in Annexes 2 and 3. Table 1 provides an example of the information presented in Annex 3.

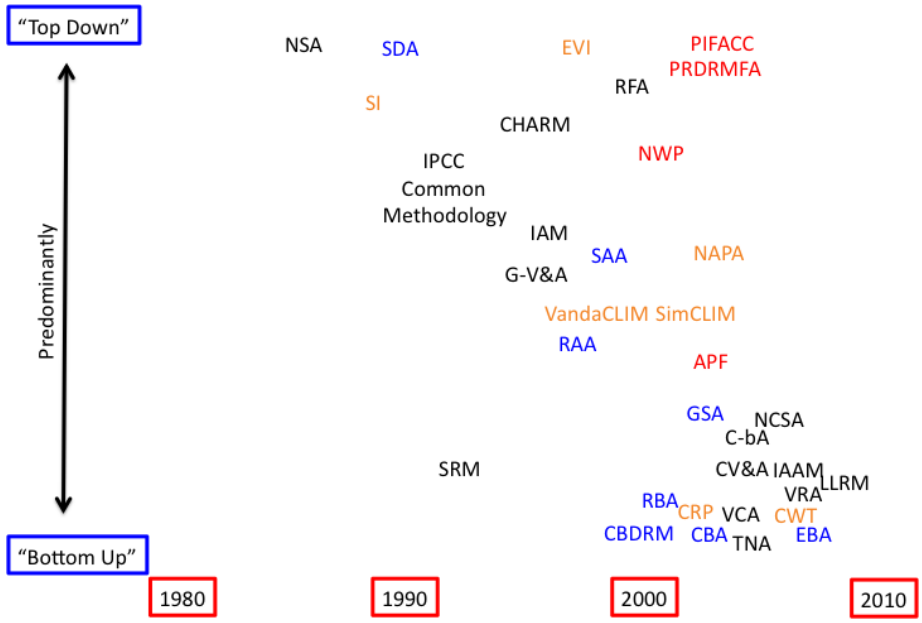

Figure 2. Progression of frameworks and assessment approaches, methods and tools used to inform adaptation and related interventions in the Pacific (see the List of Abbreviations for explanation of the acronyms used and Annex 2 for further information). Frameworks are shown in red, approaches in red, methods in black and tools are shown in orange.

The history can best be characterised as a series of somewhat independent shifts in approaches and methods more than as an evolutionary progression (Figure 3). Practice in the Pacific has paralleled, and sometimes led, the changes in approaches that have occurred globally (Warrick, 2006; Barnett and Campbell, 2010).

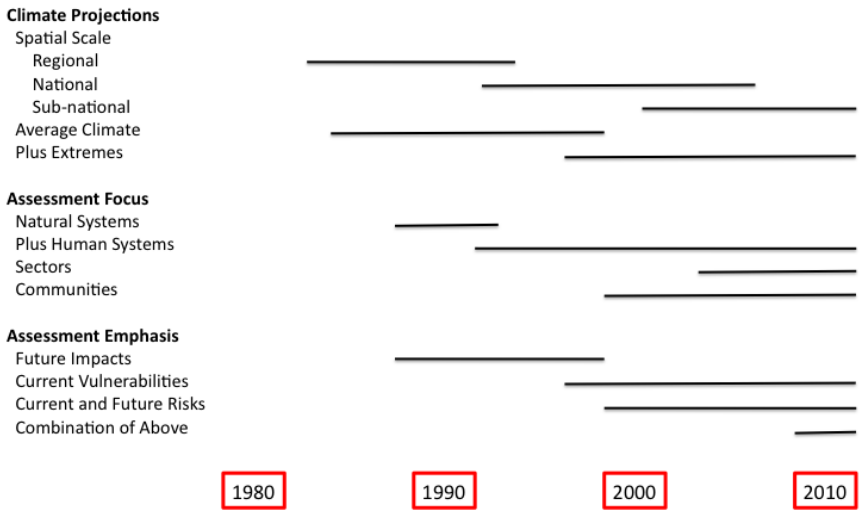

Figure 3. Indicative timing for the main approaches and assessments undertaken in the Pacific islands region.

Table 1

An Example of the Analysis Presented in Annex 3*

Category	From (in Pacific)	Name	Abbrev-iation	Key References	Intended Uses	Implementation	Findings and Examples	Strengths & Limitations
Method	Mid1990s	Stress Response Methodology	SRM	Kay and Hay (1993)	In response to the difficulties experienced in applying the CM to PICs, members of the SPREP/Japan Integrated Coastal Zone Management Programme built on and expanded the CM into a broader assessment and decision-making support framework appropriate to the South Pacific and even more widely applicable	The SRM was based on an "optimal response" to climate change by PICs being one that would enhance the resilience and decrease the vulnerability of both environmental and socio-economic systems	The methodology was applied to case study areas in Fiji, (Western) Samoa and Tuvalu	Shortcomings identified when the methodology was used in vulnerability and resilience assessments in Fiji, Samoa and Tuvalu included the subjectivity in assigning vulnerability and resilience scores to individual coastal system components, and the difficulty of quantifying intrinsic values and valuing elements of subsist-ence societies

* See Annex 2 for further information

The initial focus was on characterising possible longer-term changes in average temperature, sea level and rainfall, and the resulting physical impacts on natural and, later, human systems. National assessments and regional syntheses dominated the early work. Subsequently, collaboration with science providers from outside the region led to considerable time and other resources being spent refining and downscaling climate scenarios generated by general circulation models, in a top-down approach designed to better specify the anticipated impacts of climate change at national and sub-national scales. The key question being addressed was “how serious, or dangerous, is climate change?”. At this time one of the main motivations for the work was for PICs to be able to highlight the need for developed countries to make serious commitments to reduce their greenhouse gas emissions and to fund adaptation interventions.

During this early phase (1980s and 1990s) assessments in the Pacific, as in other developing countries, were strongly influenced by the decision of international development partners, and especially the Global Environment Facility (GEF), to focus on identifying and managing the consequences of human-induced climate change. These were widely perceived to be associated with changes in mean conditions only, with any changes in climate variability and extremes being the result of "natural variability". As a result, climate change impact assessments failed to build on the more established body of practice related to hazard identification and risk management.

This early work also largely ignored the concepts and assessment methodologies concerning vulnerability to such concerns as famine and poverty. Thus, in this early phase, vulnerability of human and natural systems to climate change was usually equated with the residual impacts after factoring in adaptation that reduced the impacts of longer-term changes in average climatic conditions.

A subsequent shift built on concepts and practice concerning vulnerability to such concerns as famine, hazards and poverty. Thus assessments of vulnerability to climate change became more bottom-up, locally driven and participatory, resulting in a multiplicity of methodologies and tools. The starting point for these assessments was typically the current vulnerability of the community, ecosystem or economy, rather than future impacts, as had previously been the case. Many assessments now evaluated two components of vulnerability, based on the experience of the system of interest: (i) the ways in which the system is susceptible to climate and other drivers of change as a result of both exposure and sensitivity; and (ii) the ability of the system to deal with the changing conditions, commonly termed the adaptive capacity.

Adaptive capacity is an inherent property of a society, determined by factors such as poverty, inequality, gender patterns and access to potable water, health care and housing. The assessment results provided the basis for identifying the processes and mechanisms through which coping and adaptive behaviours actually occur, and how they might best be strengthened and complemented in order that adaptation will occur, usually in tandem with wider development processes. Importantly, these assessments were not so much concerned with determining the seriousness of climate change as with answering the question “what does successful adaptation involve?”.

The shift to starting an assessment by considering vulnerabilities to current hazards went hand in hand with two other shifts: (i) recognition that, in the context of vulnerability, climate change will in most cases manifest as changes in the frequency and/or intensity of extreme weather and climate events; and (ii) increased use of risk-based approaches (Warrick, 2006). All three shifts proved to be mutually reinforcing,

resulting in a multiplicity of community-based approaches, all within vulnerability and risk identification and reduction frameworks.

Even more recently, some assessments are combining scenario-driven impact assessments and place-based vulnerability studies. This more holistic and often risk-based thinking sees attention focusing less on vulnerabilities and more on assessing the need for building system resilience. Resilience is measured by the magnitude of stress an ecological or social system can absorb while maintaining the same basic structure and ways of functioning, their capacity for self-organisation and their capacity to adapt to stress and change (IPCC, 2007). Building resilience is integral to enhancing adaptive capacity, thus highlighting the relationship between resilience and vulnerability. The success and sustainability of interventions aimed at increasing the ability of a community to self sufficiently cope with climate stresses is likely to depend on their resilience (Warrick, 2010).

In the Pacific there have been associated changes in approaches taken by national and regional project-based activities (Hay, 2009a), including a move away from national-scale and multi-sectoral V&A assessment projects to those with a single sector focus (e.g. Moreno and Becken, 2009). The number of projects related to the management of climate-related disasters has also grown rapidly in recent years.

3. Lessons Learned

Application of the numerous and diverse approaches reviewed above has resulted in many lessons, as described below.

No one approach or method will address all needs and accommodate all capacities. Starting with the work of the Intergovernmental Panel on Climate Change (IPCC), many of those involved in the development of assessment methods aspired for a “common methodology” (e.g. IPCC 1991; Kay and Hay, 1993). The reality is that different needs and other circumstances will invariably result in there being several fit-for-purpose and fit-for-capacity methodologies and associated tools being advocated and utilised at any one time. The approaches and methods used to assess risks and adaptation for area-wide land-use planning, infrastructure and national development are different to those applied to assess community-level vulnerability, resilience and adaptation. This is evident from the multiple approaches, methods and tools that have been used in the Pacific (Figures 2 and 3 and Table 1). However, there has been a recent convergence on community-focused and vulnerability- and risk-based approaches. These have been found to be more in tune with the recognition that in the Pacific: (i) communities will undertake most of the adaptation; and (ii) reducing the consequences of extreme weather and climate events is critical to the sustainable development and use of natural and human systems, now and in the future.

A key opportunity is ensuring that the proven qualities of methodologies are identified, and also harmonised and combined where appropriate. This will enhance efficiencies and avoid the confusion that is currently high in both the practitioner and beneficiary communities.

Assessments should reflect the special circumstances of the Pacific. Over the past two decades, and even longer, PICs and their development partners have used a wide variety of approaches to assess vulnerability, resilience and adaptation options. However, many have been found wanting. Top-down, scenario-driven or mainstreaming approaches have generally failed to deliver the intended results of enhancing resilience and reducing vulnerabilities and risks. Reasons include PICs

lacking the requisite knowledge and skills to apply such approaches. There is also a mismatch with the need for information, empowerment and action at the local scale where most adaptation decisions are made. However, assessments that have been exclusively community focused have also struggled, often because of inadequate understanding as to where and how efforts should be focused, as well as inadequate support from outside the community to ensure that assessments are provided the required information and the benefits of the resulting decisions can be sustained. For this reason, it is important that community V&A needs be reflected in the operational plans of government ministries and departments, as well as in the work plans of relevant international agencies (see, for example, Government of Samoa, 2008).

Assessments should facilitate planned rather than reactive adaptation. In recent decades there have been significant advances in short-term and seasonal weather forecasting, as well as in long-term climate modelling. These have yielded major improvements in early warnings and advisories, as well as in longer-term planning. This is resulting in increasing emphasis on proactive (i.e. anticipatory) rather than reactive management of the adverse consequences of extreme weather events and anomalous climatic conditions. It is also increasing the diversity of options able to manage those impacts. Increasingly, practitioners are seeking more rational and quantitative guidance for decision making, including cost-benefit analyses (C-bA)[1].

Lessons related to locally-based V&A assessments. While there are only a few compilations of lessons learned from community-based adaptation (CBA), community-based disaster risk management (CBDRM) and other locally-based assessments in the Pacific, some important lessons are emerging, including:

- low cost and simple field-based assessments of physical and social vulnerability and adaptive capacity can be delivered at local levels (Barnett and Campbell, 2010);
- since vulnerability to climate change is place-specific, locally perceived climate problems and priorities must be well contextualised and understood before planning and action takes place (Warrick, 2009); there will be different priorities in relation to climate change depending on the expected impacts, the vulnerability of people, and capacities; the roles and responsibilities of all actors, including governments, also need to be considered (IFRCs, 2007);
- a careful approach to community engagement is required; such approaches cannot be rushed, they need to fully respect but not unquestioningly idealise local knowledge, and are best implemented by people from within the region who understand what it means to live and work in local communities (Barnett and Campbell, 2010);
- emphasis should be placed on embedding participatory approaches in assessments if communities are to benefit fully from the process (Fazey et al., 2010);
- efforts to work with communities to generate gender-sensitive responses to, and strategies for addressing, climate change are more successful when they involve a number of responses from a variety of partners (Lane and McNaught, 2009);
- technical assessments are greatly enhanced by local inputs, but both local and formal technical knowledge is required as local knowledge may not always be technically correct (Barnett and Campbell, 2010);

[1] An analysis of the economic and social valuation of adaptation is being undertaken as part of the regional overview being prepared by PASAP. As a result, the present paper does not pursue this topic in any detail. Lessons learned regarding C-bA of local climate risk reduction initiatives can be found in Chadburn et al., 2010.

- flexibility, openness, and innovation in locally-based assessments are critical to maximising learning and knowledge consolidation, to accurately representing local voices, and to ensuring assessments are informed by, and developed from, local priorities (Warrick, 2009);
- assessment processes benefit from greater emphasis on the non-climate factors influencing vulnerability and maintaining resilience (Petrini, 2010a; Warrick 2007; 2010);
- assessments of vulnerability should be based on active involvement of local communities, examination of current vulnerability to current and anticipated climatic and non-climatic stresses and appraisals of adaptive capacities; they should also result in proposed adaptation interventions (Sutherland et al., 2005);
- assessing and building adaptive capacity is an integral part of development assistance, and should be seen as an ongoing process rather than a one off initiative (Hay, 2009b);
- if adaptation is to reduce community vulnerability, it must target stresses that are a reality at the local scale, whether or not these are obviously related to climate or climate change; therefore assessments should identify creative ways to address local concerns and priorities while also increasing adaptive capacity (Warrick 2007; 2010);
- information about climate change and adaptation should be disseminated and shared continually throughout V&A assessment projects, using vernacular language and simple terms; information should also be shared between similar projects and communities, including the failures as well as the successes (Aalbersberg et al., 2010; Limalevu and Weir, 2005; Limalevu, 2010); and
- Long-term adaptive monitoring, maintenance and evaluation should begin early in a V&A assessment project, and continue for five to ten years as many outcomes will not be apparent until then (Aalbersberg, 2010; Limalevu and Weir, 2005; Limalevu, 2010);

Some lessons learned regarding capacity building for V&A assessments. Building capacity for all facets of climate change responses should be a needs-driven, ongoing and evolutionary process. It should enhance the capacity of all relevant ministries, sectors and communities to carry out climate change adaptation activities. Important synergies can be achieved if capacity building reflects the cross-cutting nature of climate change. Wherever possible, capacity building should not be project based, but an integral part of a longer-term action plan. Moreover, disseminating knowledge of climate change on its own is insufficient. People need to be empowered to take action to reduce risk in their lives (IFRCS, 2007).

Experience in the Pacific emphasises the importance of good governance (SOPAC, 2009), and the need for strong climate change leadership at both community and national levels (Hay, 2009c). Elrick and Kay (2009a) found that minimising external support during meetings of adaptation working groups facilitated the emergence of leaders who could provide guidance and direction to members. Such a lesson is important since, as Kenny (2010) notes, even after an extensive regional-level assessment training course national participants were still not enabled to prepare country statements for reporting under the United Nations Framework Convention on Climate Change (UNFCCC). Completion of the reports required additional support from international consultants.

Some lessons learned related to regional frameworks. There are two regional frameworks, one for climate change responses (the Pacific Islands Framework for Action on Climate Change (PIFACC)) and the other for disaster risk management (the Pacific Disaster Risk Reduction and Disaster Management Framework for

Action). This is a result, in part, of the initial separation of climate change responses and management of climate-related hazards.

More recent shifts increasingly recognised the strong linkages between climate adaptation and disaster risk reduction, especially in the development and humanitarian contexts (see Section 2). As a result, the significant complementarities and congruencies between the two regional frameworks are now being exploited more fully (Hay, 2009d). A key implication for assessment approaches and methods is an increase in joint programming at national level by regional and international organisations, since at the operational level in countries and communities, disaster risk reduction and climate change adaptation are largely indistinguishable (Hay, 2010). This highlights the need for increased harmonization of assessment approaches and methods. Both communities of practice aim to reduce the vulnerability of societies to hazards by improving the ability to better anticipate, resist and recover from their impacts. Moreover, disaster risk reduction efforts have resulted in many tried and tested methods and tools for addressing risk. These can add substantial value to V&A assessments.

4. Success Stories and Success Factors

Successful vulnerability, risk and adaptation assessment approaches, methods and tools are described in Table 2. These were identified on the basis of the analysis presented in Annex 3. The specific criteria used to identify success are presented in Annex 1.

These and the many other successes in the Pacific region, as well as the lessons learned, suggest the following success factors. Success with V&A assessments comes when they are:

- pursued in a way that includes learning from past experience while also considering future conditions and needs, including those of people who will be most vulnerable in those circumstances;
- conducted in harmony with the community and household work schedules (e.g. timing and priorities) and in ways that are sensitive to the community structure (Limalevu and Weir, 2005; Limalevu, 2010);
- supported from groups outside the community; analysis and recommendations of experts (e.g. members of the public works department, local government such as provincial offices, traditional leaders, NGOs) should be incorporated into the project to avoid technical mistakes (Limalevu and Weir, 2005; Limalevu, 2010);
- undertaken in ways that build on enhanced climate response capacities at community level; these would recognise that the men and women of the Pacific are not victims of climate change, but active agents - through their own gendered knowledge and actions, individuals, households and communities can exacerbate or minimise the impact of weather and climate extremes;
- based in part on the experience gained in participatory development activities, and therefore they are community-driven and empowering, with ongoing efforts to enhance adaptive capacity;
- undertaken in conjunction with a simple and user-friendly monitoring and evaluation framework and local champions are used to mobilise communities (Petrini, 2010a);
- implemented by a local community empowered to adapt through an inclusive, transparent and participatory process that combines bottom-up and top-down approaches which engage the community in the exploration of options to reduce vulnerability and effectively balance the needs and interests of the various stakeholders;

Table 2

Successful Use of Vulnerability, Risk and Adaptation Assessment Approaches, Methods and Tools in the Pacific

Assessment Approach, Method or Tool	Context	Evidence*	References
Vulnerability and Adaptation Assessment and Action Methodology (CV&A)	Between 2002 and 2005 the Capacity Building for the Development of Adaptation Measures in Pacific Island Countries (CBDAMPIC) funded sixteen pilot CBA projects in four PICs. It developed and applied the Community Vulnerability and Adaptation Assessment and Action Methodology (CV&A);	The CPDAMPIC project succeeded to improve the conditions for nine communities (almost 4000 people) with relatively low financial inputs of USD 600,000 from Canada and in-kind contributions of more than USD 600,000; the University of the South Pacific has developed and successfully applied an Integrated Assessment and Action Methodology (IAAM) for Climate Change, Disaster Risk Management and Sustainable Development; this methodology evolved from the CV&A methodology; the recently commenced Pacific Adaptation to Climate Change (PACC) Project has adopted an action framework that fuses national mainstreaming and community-based approaches, using IAAM	Limalevu and Weir (2005) Kouwenhoven and Cheatham (2006) Nakalevu (2009)
Vulnerability Reduction Assessment (VRA)	The VRA structure is based on key steps for designing adaptation projects as laid out in Adaptation Policy Framework (APF) develop by the United Nations Development Programme (UNDP). The VRA is itself based on a similar approach called the Threat Reduction Assessment methodology commonly used in biodiversity projects. VRA was used to assess the success of CBA initiatives in 11 villages in Samoa; six of 11 villages increased their VRA scores in one year, indicating an increase in their adaptive capacity	Repeated application of VRA in the 11 CBA projects showed where and why some interventions were successful, and where and why others were not, leading to lessons learned (see Section 3)	Droesch (2008) Petrini (2010b)
Vulnerability and	Since the 1990s the International Federation of Red	12 PICs have now used VCA; seed funding is	IFRCS (2006)

Capacity Assessment (VCA)	Cross/Red Crescent Societies (IFRCS) has been using VCA to help communities assess and address the risks they are facing; VCA is a method of working with people in rural and urban communities that is similar to the participatory approaches used for many years by several non-governmental organisations (NGOs) in their development work	being provided to address community level priorities coming out of the VCA process	IFRCS (2007) IFRCS (2009)
Risk-based Adaptation (RBA)	The first risk-based climate assessment in the Pacific determined risks related to sea-level rise and coral reefs for global emissions scenarios with and without implementation of the Kyoto Protocol; detailed coastal protection design criteria for part of Rarotonga, Cook Islands, were assigned a statistical return period or average recurrence interval; case studies demonstrated a risk-based approach to adaptation in the Cook Islands and the Federated States of Micronesia; the Kiribati Adaptation Project has demonstrated how a regional climate model can be used to generate information that will better inform local understanding of the potential changes in climate extremes such as the incidence of droughts and extreme rainfall events; the APF provides guidance on risk-based identification of appropriate adaptation strategies, policies and measures	Elrick and Kay (2009b) used a strategic, top-down risk management framework (similar to the APF) when identifying appropriate ways to manage coastal climate change risks in Kiribati; climate risk profiles (CRPs) prepared for ten PICs have been used in preparation of ADB's Climate Change Implementation Plan for the Pacific and in many V&A assessments; the PACC Project is identifying and addressing the risks posed by climate change through pilot scale adaptation in the coastal management, food security and water resources sectors; capacity to integrate climate risk management into wider management decision-making processes at the national, sub-national and project levels is also being built by the PACC project	Jones et al. (1999) GHD and SEA (2005) ADB (2005) NIWA (2008) Lim et al. (2004) ADB (2010) Hay (2009e)
Cost-benefit Analysis (C-bA)	The costs and benefits of climate proofing completion of the circumferential road in Kosrae, Federated States of Micronesia, were evaluated; the results showed that, while building a climate resilient road might initially cost an additional USD 0.5 million, within 15 years overall costs would be less due to less maintenance and repairs, reflecting an internal rate of return of 11%	Based on the results of the C-bA, Kosrae State politicians agreed to postpone completion of the road section until the additional funds (USD 0.5 million) could be secured; construction of the climate proofed road is now proceeding, with incremental costs funded by GEF	ADB (2005) Nakalevu (2009)
Integrated Assessment Model (IAM)	SimCLIM is the generic name applied to an IAM used to examine the impacts and adaptations to	Nauru, Solomon Islands, Tonga, Tuvalu and Vanuatu) are now using SimCLIM in the V&A	Warrick et al. (2005) Warrick (2006)

	climate variability and change; it evolved from a "hard-wired" IAM for New Zealand; subsequent derivations were developed for some PICs (to support assessments, including those related to their Initial National Communications to the UNFCCC) and other countries, including Australia, Bangladesh, the Philippines and China	assessments that will be reported in their Second National Communications to the UNFCCC	Warrick (2009) www.climsystems.com /about/activities.php
VCA Toolkit	The Toolkit is used to support VCA (see above); it can be used in communities to help assess vulnerability and capacity as well as action planning and implementation to reduce risk from natural hazards; it includes step-by-step descriptions of how to use each tool, including gender considerations	Further refinement of the VCA toolbox to the Pacific context is underway, based on a regional sharing of experience and lessons learned	IFRCS (2007) Lane and McNaught (2009)
WWF Climate Witness Toolkit	The Toolkit includes an education and awareness component based on knowledge held by men and women in PIC communities about the impacts that changes in climate are having upon their fragile ecosystems	The methodologies within the toolkit are an adaptation of participatory techniques WWF-South Pacific has used over the years in community resource conservation and development projects; they are designed to illicit information specific to impacts of climate change and developing appropriate community response measures	WWF South Pacific Programme (2009)
National Adaptation Programmes of Actions (NAPA) Guidelines	In the Pacific, five least developed countries (LDCs) have been funded to prepare NAPAs using, in part, annotated guidelines and a step-by-step guide prepared by the LDC Expert Group; key assessment steps include synthesis of available information, rapid participatory vulnerability assessment, consulting stakeholders and the public, identifying potential NAPA activities, prioritising criteria and screening and ranking activities, and preparing NAPA project profiles	All five PIC LDC's have experienced an accelerated implementation of adaptation measures, most notably Samoa; this success has inspired other PICs (e.g. Cook Islands) to prepare national adaptation plans.	Government of Samoa (2008) Desanker (2004) LDC Expert Group (2009a) LDC Expert Group (2009b)
Local Government Climate Change Adaptation Toolkit	The assessment and adaptive management process used in this toolkit merges the Australian Government's risk management framework with the	The tools and exercises have been reviewed, tested and successfully applied by several councils in Australia; while there is no evidence	ICLEI-Oceania (2008)

	capacity building frameworks that ICLEI Oceania has developed over the years of supporting the Cities for Climate Protection Adaptation Initiative; the process in the toolkit is designed to build a councils' capacity to make decisions using, rather than generating, scientific projections or climate change impact models. The decisions encompass the full range of council responsibilities when planning for climate change impacts, including resource management, land-use planning, infrastructure and transport planning, local economic development, environmental management, community issues and emergency services	that local government agencies in PICs have used the Toolkit, the focus on infrastructure and transport planning, local economic development, environmental management, community issues and emergency services, among others, means the Toolkit does have relevance to many cities in PICs	

* See Annex 1 for criteria used.

- conducted in ways that acknowledge and utilise the comparative advantages of key players; for example, the principal role of government is to ensure a strong enabling environment for adaptation (policy, legislation, institutional support, coordination, information, funding (including that provided by development partners), education, training, technology assessment and transfer (such as the needs assessment funded under the UNFCCC), while communities, the private sector and NGOs should have principal responsibility for implementation, often working as partners;
- focused on identifying and exploiting the co-benefits between adaptation to climate change, disaster risk reduction, economic and social development and environmental protection - the small size, and highly integrated nature and sensitivity of Pacific island economies, societies and natural ecosystems makes this both desirable and practicable; and
- carried out using a risk-based approach - generic risk management methodologies (e.g. the ISO 31000 risk assessment standard) have a strong practical linkage between risk assessment and risk mitigation; PICs and others have always had difficulty progressing in a rational and rigorous way from assessing impacts and impact-based vulnerabilities to identifying adaptation and other climate risk management options, a problem that a risk-based approach has been shown to overcome (ADB, 2005).

5. Key Gaps in Information and Understanding

An analysis of key gaps in information and understanding related to climate change-related assessment approaches, methods and tools is beyond the scope of this review. Nevertheless, the review has led to the identification of some key gaps which are worthy of highlighting, namely:

- many Pacific islanders are increasing their knowledge and skills related to climate risk management; at the same time, policy-makers and planners are wishing to make climate-related decisions which are better informed; the result is a growing gap between the information required and that which is available; PASAP is one of many initiatives designed to help fill this gap; and
- the Pacific has benefited from over 20 years of assessment experience, gained both within and outside the region; however, the lessons learned are few in number, inadequately documented and communicated, and hence often not put into practice; improved monitoring, evaluation and reporting of adaptation initiatives, including those related to disaster risk reduction, would help address this gap, as would documenting instances of mal-adaptation,.

Further information on these and other gaps is provided in Annex 4.

6. Common Understanding and Possible Principles Relevant to Harmonising Understanding and Action

This section builds on the earlier findings of the present study and integrates them by identifying areas of common understanding related to the assessment of climate change impacts, vulnerabilities and possible adaptation interventions in the Pacific islands region. The common understanding is presented as a series of principles aimed at harmonising understanding and action. These are in turn used to guide identification of the climate change-related assessment approaches best suited to the region, as described in Section 7.

The proposed principles are:

1. Supporting communities, the private sector and countries in the Pacific through

the provision of assessment advice and other technical assistance is critically important, but technical studies of V&A should lead to action and enduring outcomes, not just a report;
2. Vulnerability assessment, and adaptation prioritization and implementation approaches should be fit for both purpose and context;
3. Assessments of impacts, vulnerabilities and possible adaptation interventions related to climate change should also reflect wider development and humanitarian considerations, including the Millennium Development Goals and the needs and potential contributions of women, men and children, on an equitable basis;
4. Regardless of scale and focus (e.g. national, community, sector, vulnerable groups, at risk locations, cross-cutting) the main emphasis of assessments should be on characterising current weather- and climate-related risks and vulnerabilities and how best to reduce them, including by increasing adaptive capacity;
5. Traditional knowledge, and especially local cultural knowledge that is flexible and adaptable with changing situations, is an important component of adaptive capacity, alongside non-traditional knowledge; both forms of knowledge should be subject to assessments of accuracy and relevance;
6. Knowledge of how future changes in climate, and especially changes in extreme weather and climate events, will modify vulnerabilities and influence development is critical to the identification and assessment of priority adaptation interventions, including disaster risk reduction; and
7. Monitoring and evaluation of assessments and the resulting interventions will facilitate recognition of what constitutes good adaptation and how to avoid mal-adaptive practices; this can result in a significant reduction in the overall costs of adaptation and will go a long way towards ensuring long-term resilience to climate change.

7. Vulnerability and Adaptation Assessment Approaches Best Suited to the Region

It is appropriate to again highlight the point made in Section 3, namely that no one approach can address all needs or accommodate all capacities. Thus this section is limited to proposing a higher-level framework. It is intended to help rationalise the individual assessment approaches, methods and tools that reflect the specific circumstances under which they are used.

Figure 4 is a visualization of a proposed higher-level framework for V&A assessments. It highlights the important dimensions of spatial scale (e.g. regional, community) and focus (e.g. country, sector, at-risk group) for any assessment. Assessments should be informed by the past (e.g. traditional knowledge; coping strategies) and anticipate the future (e.g. rights of future generations; development and climate scenarios; adaptation plans). However, any assessment should be grounded in the present, reflecting the principal (Section 6) that emphasis should be on characterising current weather- and climate-related risks and vulnerabilities and how best to reduce them, including by increasing adaptive capacity.

Two specific assessment approaches are identified, namely vulnerability- and risk-focused assessments. These have much in common, but are distinguished mainly in terms of their emphasis on identifying and reducing either vulnerabilities or risks, as well as in terms of terminology used (Figure 4). Assessing adaptive capacity is an explicit component of a vulnerability assessment, while the ability to manage risks (e.g. strength of the enabling environment, including mainstreaming of climate risk management) is only an implicit element in the assessment of risk reduction options.

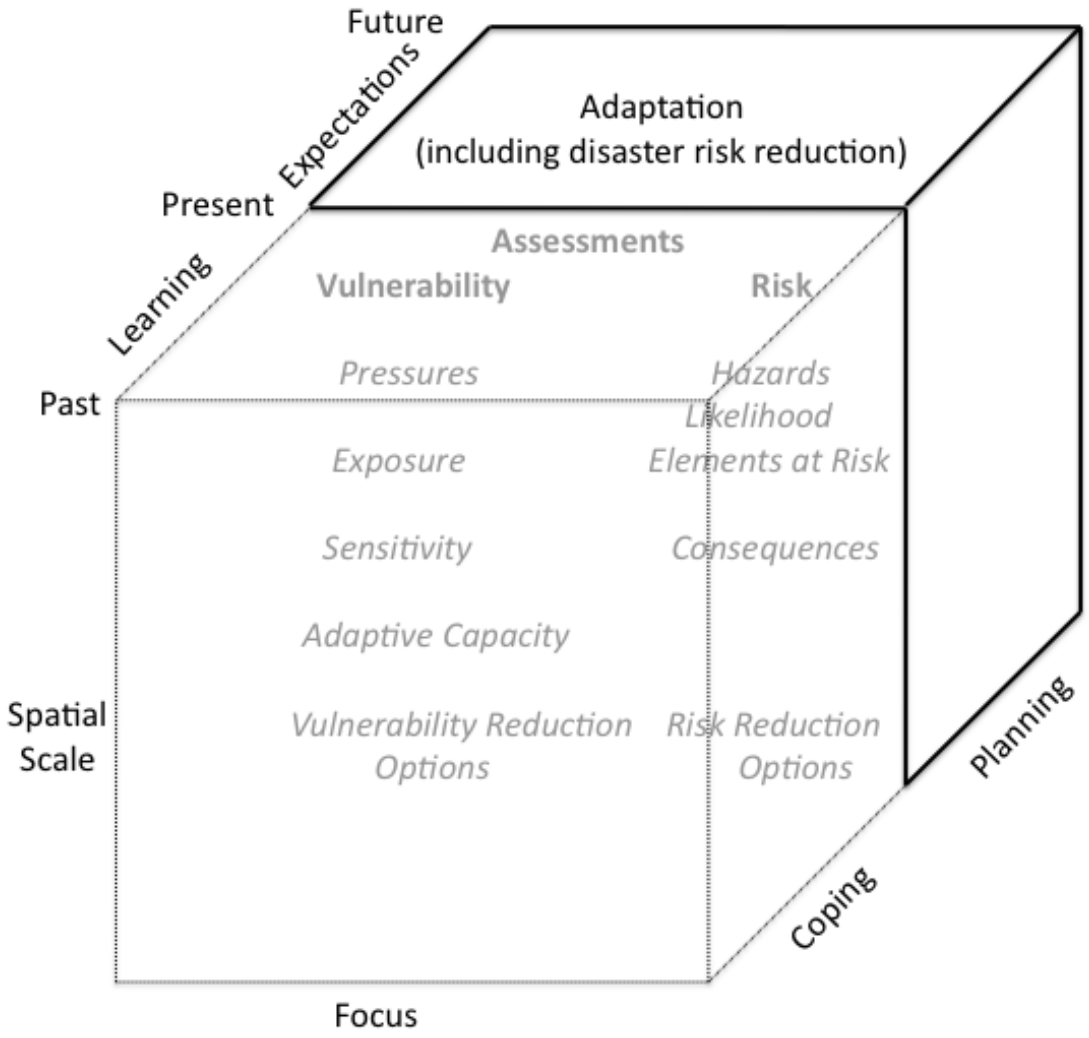

Figure 4. Visualization of a proposed higher-level framework for V&A assessments.

Importantly, a risk-based approach does not in itself require complex, scenario-based risk characterization activities. Rather, it can often be limited to combining local perceptions and understanding of risk with readily available knowledge of how those risks might be exacerbated by climate change.

Both approaches are proposed here as being “best suited to the region”. This is because: (i) they conform to the principles developed in the present study to assist in harmonising understanding and action; (ii) the associated methods and tools (e.g. RBA and the associated CRPs; VCA and the associated VCA Toolkit) have a history of successful use globally as well as in the region; (iii) they have also evolved to better suit regional circumstances, in part based on lessons learned; and (iv) there is a rapidly growing capacity at regional, national and community levels to apply these approaches (Hay, 2009d).

While the two approaches have many commonalities, circumstances may suggest when use of one or the other is more appropriate. Vulnerability-focused assessments have proven to be more effective at community level while risk-based assessments tend to be more suited to infrastructure and sectoral applications. However, there are

examples of vulnerability-focussed sectoral assessments (e.g. application of IAAM in the water resources sector in Fiji (CIFOR, 2010; Limalevu, 2010)) and of risk-based approaches being used at community level (e.g. application of RBA in communities in Pohnpei and Rarotonga (ADB, 2005)). Both approaches can contribute to mainstreaming and related "top-down" activities such as "climate proofing" policies, plans and regulations, institutional strengthening and mobilising financial resources. They can also contribute to "bottom-up" initiatives such as community empowerment and ownership of initiatives that reduce vulnerabilities and enhance resilience to climate change.

Both assessment approaches underpin climate risk management, an integrating concept that explicitly brings together the different time-dimensions of climate-related disaster management, disaster risk reduction and climate change adaptation, including ongoing and future changes in risks, as well as uncertainties. Thus climate risk managements ranges from preparedness and disaster mitigation to broader adaptive responses and building community resilience.

8. Conclusions and Recommendations

Even though assessment activities tend to share the common objective of reducing vulnerabilities and risks, practitioners in the Pacific are using numerous approaches, methods and tools to assess vulnerabilities and identify possible adaptation interventions. No one approach will address all needs and accommodate all capacities. Rather, several successful approaches have been identified, along with a selection of methods and tools. Success is based on evidence of the approach, method or tool: (i) being replicated/upscaled; (ii) making a critical contribution to reducing vulnerabilities/risks; and (iii) being used to inform the development of another successful approach, method or tool.

A higher-level framework for V&A assessments is proposed. This accommodates the various approaches, methods and tools commonly used in the Pacific. In addition, two V&A assessment approaches have been identified as being "best suited to the Pacific region", namely vulnerability- and risk-focused assessments. Both conform to the principles that the present study has developed to assist in harmonising understanding and action. The associated methods and tools have a history of successful use globally, as well as evolving to better suit regional circumstances. There is also a rapidly growing capacity at regional, national and community levels to apply these approaches.

However, there is an increasing gap between the information required to undertake such assessments and that which is currently available. Information needs are also growing because policy-makers and planners are wishing to make better informed, climate-related decisions. At the same time Pacific islanders are increasing their knowledge and skills related to climate risk management. The present study has identified many of the specific information gaps which should be filled as a matter of urgency, using a combination of regional and national initiatives.

While the Pacific has benefited from over 20 years of assessment experience, based on activities undertaken both within and outside the region, few lessons learned have been adequately documented and communicated. As a result there are all too few examples of lessons learned being put into practice. Strengthening the monitoring, evaluation and reporting of adaptation-related initiatives can help address this issue. This should include initiatives related to disaster risk reduction. Documenting instances of mal-adaptation would also help address this gap.

9. References

Aalbersberg, W., Dumaru, P., Limalevu, L. and T. Weir, 2010: Community Adaptation In Fiji: Some Lessons Learnt. PACE-SD Occasional Paper No. 2010/1, University of the South Pacific, Suva, Fiji, 8pp.

ADB, 2005: Climate Proofing: A Risk-based Approach to Adaptation. [prepared by Hay, J.E., R. Warrick, C. Cheatham, T. Manarangi-Trott, J. Konno and P. Hartley] Asian Development Bank, Manila, 191pp.

ADB, 2010: Mainstreaming Climate Change in ADB Operations: Climate Change Implementation Plan for the Pacific (2009–2015), Asian Development Bank, Manila, Philippines, 137pp.

Air Worldwide Corporation, 2008: Country Risk Profiles. General Methodology, Pacific Catastrophic Risk Financing Initiative. 6pp.

American Meteorological Society, 2010: The State of the Climate in 2009. Bulletin of the American Meteorological Society, 10pp.

Anderson, C., 2008: Forum on the Gendered Dimensions of Disaster Risk Management and Adaptation to Climate Change: Ways forward for collaboration on research and programming in the Pacific. Workshop Report, Holiday Inn Hotel, Suva, Fiji, February 20 and 21, 2008, UNDP Pacific Centre, 50pp.

Ayers, J. and S. Huq, 2009: Community-based Adaptation to Climate Change: An Update. IIED Briefing Note, International Institute for Environment and Development (IIED), London, U.K, 4pp.

Bettencourt, S., Croad, R., Freeman, P., Hay, J. and 10 others, 2006: Not If But When: Adapting to Natural Hazards in the Pacific Islands Region. Pacific Islands Country Management Unit, World Bank, 46pp.

Campbell, J. R., 2006: Traditional disaster reduction in Pacific Island communities, GNS Science Report 2006/38, 46pp.

Carter, T.R., Parry, M.L., Harasawa, H. and S. Nishioka, 1994: IPCC technical Guidelines for Assessing Climate Change Impacts and Adaptations. Intergovernmental Panel on Climate Change (IPCC), Geneva, Switzerland, 59pp.

Carter, T.R., Jones, R., Lu, X., Bhadwal, S., Conde, C., Mearns, L., O'Neill, B., Rounsevell, M. and M.B. Zurek, 2007: New Assessment Methods and the Characterisation of Future Conditions. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 133-171.

Chadburn, O., Ocharan, J., Kenst, K., and Cabot Venton, C., 2010: Cost Benefit Analysis for Community Based Climate and Disaster Risk Management: Synthesis. Tearfund and Oxfam America, 56pp.

Chandra, A. and J.A. Dalton, 2010: Mainstreaming Adaptation within Integrated Water Resources Management (IWRM) in Small Island Developing States (SIDS): A

Case Study of the Nadi River Basin, Fiji Islands. In Pérez, A., Fernandez, H. and C. Gatti, 2010: Building Resilience to Climate Change: Ecosystem-based adaptation and lessons from the field. International Union for Conservation of Nature and Natural Resources (UUCN), Gland, Switzerland, 46-59pp.

CIFOR, 2010: Quarterly Activity Report 9, October – December, 2009, Centre for International Forestry Research, Bogor, Indonesia, 5pp.

Cummins, J.D and O. Mahul, 2009: Catastrophe Risk Financing in Developing Countries. The World Bank, Washington, D.C., 299pp.

Desanker, P., 2004: The NAPA Primer, United Nations Framework Convention on Climate Change, Bonn, Germany, 201pp.

Droesch, A.C, Gaseb, N., Kurukulasuriya, P., Mershon, A., Moussa, N., Rankine, D. and A. Santos, 2008: A Guide to the Vulnerability Reduction Assessment, UNDP Working Paper, Community-Based Adaptation Programme, United Nations Development Programme (UNDP), 13pp.

Elrick, C. and Kay, R. 2009a: Mainstreaming of an Integrated Climate Change Adaptation Based Risk Diagnosis and Response Process into Government of Kiribati: Final Report. Report prepared for the KAP Project, Phase II. Coastal Zone Management Pty Ltd, Perth, 67pp.

Elrick, C. and Kay, R., 2009b: Adaptation Handbook: Undertaking Risk Treatment for Coastal Climate Change Risks in the Republic of Kiribati. Prepared for Kiribati Adaptation Project Phase II (KAP II), Government of Kiribati, 32pp.

Fazey, I., Kesby, M., Evely, A., Latham, I., Wagatora D., Hagasua, J-E., Reed, M., and Christie, M., 2010: A three-tiered approach to participatory vulnerability assessment in the Solomon Islands, Global Environmental Change, 20, 713–728.

GEF Global Support Programme, 2005: Resource Kit for National Capacity Self-Assessment. United Nations Development Programme (UNDP), New York, 85pp.

Gero, A., Méheux, K. and D. Dominey-Howes, 2010: Integrating community based disaster risk reduction and climate change adaptation: examples from the Pacific. Natural Hazards and Earth System Sciiences, 11, 101–113.

GHD and SEA, 2005: Coastal Protection Feasibility Study. SOPAC, Suva, Fiji, 77pp.

Government of Samoa, 2008: Status of the Implementation of Samoa's National Adaptation Programme of Action (NAPA) for Climate Change. Ministry of Natural Resources and Environment, 9pp.

Government of Samoa, 2010: Samoa's Second National Communication to the United Nations Framework Convention on Climate Change, United Nations Framework Convention on Climate Change, Bonn, Germany, 99pp.

Haigh, C. and Vallely, B., 2010: Gender and the Climate Change Agenda: The Impacts of Climate Change on Women and Public Policy, Women's Environmental Network, 65pp.

Hay, J.E., 1993a: Climate change science: A view from the South Pacific. Climate Change and Sea Level Rise in the South Pacific Region: Proceedings of the Second

SPREP Meeting, J. Hay and C. Kaluwin (eds). South Pacific Regional Environment Programme, Apia, Western Samoa, 17-22.

Hay, J.E., 1993b: Potential impacts of climate change on Pacific island nations. Climate Change and Sea Level Rise in the South Pacific Region: Proceedings of the Second SPREP Meeting, J. Hay and C. Kaluwin (eds). South Pacific Regional Environment Programme, Apia, Western Samoa, 182-185.

Hay, J.E., 2009a: Assessment of Implementation of the Pacific Islands Framework for Action on Climate Change (PIFACC). Prepared for the Pacific Regional Environment Programme (SPREP), Apia, Samoa, 20pp.

Hay, J. E., 2009b: Implementation of the Pacific Adaptation to Climate Change (PACC) Project: Process, Status and Assessment. Technical Report, Secretariat for the Pacific Regional Environment Programme (SPREP), Apia, Samoa.

Hay, J.E., 2009c: Pacific Future Climate Leaders' Programme: Design Specifications. Prepared for Australia's Agency for International Development and submitted through Cardno Acil, Ltd., 42pp.

Hay, J.E., 2009d: Institutional and Policy Analysis of Disaster Risk Reduction and Climate Change Adaptation in Pacific Island Countries. Report prepared for the United Nations International System for Disaster Reduction and the United Nations Development Programme, Suva, Fiji, 134pp.

Hay, J.E., 2010: Mid-Term Review, Pacific Islands Framework for Action on Climate Change (PIFACC) and the PIFACC Action Plan: Findings, Options and Recommendations. Report prepared for the Pacific Regional Environment Programme, 42pp.

Hay, J.E. and C. Kaluwin, 1993: Climate Change and Sea Level Rise in the South Pacific Region: Proceedings of the Second SPREP Meeting, J. Hay and C. Kaluwin (eds). South Pacific Regional Environment Programme, Apia, Western Samoa, 238pp.

Hay, J.E. and Mimura, N., 2010: The changing nature of extreme weather and climate events: risks to sustainable development. Geomatics, Natural Hazards and Risk, 1(1), pp 1–16.

Hay, J.E. and C. Schuster, 2009b: Review of NZAID Support to the Global Environment Facility's Small Grants Programme. Prepared for the New Zealand Agency for International Development (NZAID), Ministry of Foreign Affairs and Trade, Wellington, New Zealand, 139pp.

Heitzmann, K., Canagarajah, R.S and P.B. Siegel, 2002: Guidelines for Assessing Risk and Vulnerability. SP Discussion Paper 0218. Social Protection Unit, Human Development Network, The World Bank, Washington, D.C.

Heltberg, R., Jorgensen, S. and P. Siegel, 2008: Climate Change, Human Vulnerability, and Social Risk Management. Social Development Department, The World Bank, Washington, D.C., 56pp.

ICLEI Oceania, 2008: Local Government Climate Change Adaptation Toolkit. ICLEI – Local Governments for Sustainability (formerly the International Council for Local Environmental Initiatives (ICLEI)), Melbourne, Australia, 68pp.

IFRCS, 2006: What is VCA? An introduction to Vulnerability and Capacity Assessment. International Federation of Red Cross and Red Crescent Societies, Geneva, Switzerland, 51pp.

IFRCS, 2007: Preparing for a Changing Climate: Case Study. Pacific Delegation, Pacific Red Cross Societies, International Federation of Red Cross and Red Crescent Societies, Suva, Fiji, 4pp.

IFRCS, 2009: Plan 2010-2011 Pacific Region. Pacific Delegation, Pacific Red Cross Societies, International Federation of Red Cross and Red Crescent Societies, Suva, Fiji, 21pp.

IPCC, 1991: Assessment of the Vulnerability of Coastal Areas to Sea Level Rise: A Common Methodology. Response Strategies Working Group, Intergovernmental Panel on Climate Change, Geneva, Switzerland, 56pp.

IPCC, 2007: Summary for Policymakers. In: Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 7-22.

Jones, R.N., Hennessy, K.J., Page, C.M., Pittock, A.B., Suppiah, R., Walsh, K.J.E. and P.H. Whetton, 1999: Analysis of the Effects of the Kyoto Protocol on Pacific Island Studies. Part Two, Regional Climate Change Scenarios and Risk Assessment Methods. South Pacific Regional Environment Programme, Apia, Samoa, 75pp.

Kaly, U., L., Briguglio, H. Mcleod, S. Schmall, C. Pratt, and R. Pal 1999. Environmental Vulnerability Index (EVI) to Summarise National Environmental Vulnerability Profiles. SOPAC Technical Report, SOPAC. 275, Suva, Fiji.

Kay, R.C. and J.E. Hay, 1993: Possible future directions for integrated coastal zone management in the Eastern Hemisphere: a discussion paper. In Eastern Hemisphere Workshop on the Vulnerability Assessment of Sea Level Rise and Coastal Zone Management, N. Mimura and R. McLean (eds). Intergovernmental Panel on Climate Change Regional Workshop, Tsukuba, Japan, 181-194.

Kenny, G., 2010: Personal Communication.

Kouwenhoven, P. and Cheatham, C., 2006: Economic Assessment of Pilots – Final Report. Capacity Building to Enable the Development of Adaptation Measures in Pacific Island Countries (CBDAMPIC) Project. Report submitted to SPREP by the International Global Change Institute (IGCI), University of Waikato, Hamilton, New Zealand, 64pp.

Lane, R. and McNaught, R., 2009: Building gendered approaches to adaptation in the Pacific. Gender and Development, 17(1), 67-80.

LDC Expert Group, 2009a: Step-By-Step Guide for Implementing National Adaptation Programmes of Action. United Nations Framework Convention on Climate Change, Bonn, Germany, 82pp.

LDC Expert Group, 2009b: National Adaptation Programmes Of Action: Overview of preparation, design of implementation strategies and submission of revised project

lists and profiles. United Nations Framework Convention on Climate Change, Bonn, Germany, 36pp.

Lim, B. and Spanger-Siegfried, E., 2004: Adaptation Policy Frameworks for Climate Change: Developing Strategies, Policies And Measures, UNDP, New York, 254pp.

Limalevu, L., 2010: Climate Change Adaptation in Rural Communities in Fiji (CCA) Project. Final Project Report, Pacific Centre for Environment and Sustainable Development (PACE-SD), University of the South Pacific, 58pp.

Limalevu, L. and Weir, T, 2005: Vulnerability in Samoa, Tiempo, 54.

Lu, X., 2006: Guidance on the Development of Regional Climate Scenarios for Application in Climate Change Vulnerability and Adaptation Assessments within the Framework of National Communications from Parties not Included in Annex I to the United Nations Framework Convention on Climate Change, National Communications Support Programme, UNDP-UNEP-GEF New York, USA, 42pp.

McGregor, G., 1988: Possible consequences of climatic warming in Papua New Guinea with implications for the tropical South West Pacific area. In Potential Impacts of Greenhouse Gas Generated Climatic Change and Projected Sea-Level Rise on Pacific Island States of the SPREP Region, Association of South Pacific Environmental Institutions (ASPEI). Prepared for the MEDU Joint Meeting of the Task Team on Implications of Climatic Change in the Mediterranean, Split, Yugoslavia, October, 1988, 26-41.

McGregor, G., 1990: Possible impacts of climatic change on human thermal comfort in the western tropical Pacific. In Global Warming-Related Effects on Agriculture and Human Health and Comfort in the South Pacific, P. Hughes and G McGregor (eds). Report prepared by the Association of South Pacific Environmental Institutions (ASPEI) for the South Pacific Regional Environment Programme (SPREP) and the Oceans and Coastal Areas Programme Activity Centre, United Nations Environment Programme, Nairobi, Kenya, 98-113.

McKenzie, E., Prasad, B. and A. Kaloumaira, 2005: Economic Impact of Natural Disasters on Development In The Pacific, Volume 1. Research Report, South Pacific Applied Geoscience Commission (SOPAC), Suva, Fiji, 92pp.

Malone, E., Smith, J., Brenkert, A., Hurd, B., Moss, R. and D. Bouille, 2004: Developing Socioeconomic Scenarios for Use in Vulnerability and Adaptation Assessments, UNDP, New York, US, 48pp.

Moreno, A. and S. Becken, 2009: A climate change vulnerability assessment methodology for coastal tourism. Journal of Sustainable Tourism, 17(4), 473-88.

Nakalevu, T., 2006a: Capacity Building for the Development of Adaptation Measures in Pacific Island Countries Project. Final Report, Secretariat of the Pacific Regional Environment Programme (SPREP), Apia, Samoa, 62pp.

Nakalevu, T., 2006b: CV&A: a Guide to Community Vulnerability and Adaptation Assessment and Action. Secretariat of the Pacific Regional Environment Programme (SPREP), Apia, Samoa, 47pp.

Nakalevu, T., 2009: Inception Phase Report, Pacific Adaptation To Climate Change (PACC), SPREP, Apia, Samoa, 67pp.

NIWA, 2008: Kiribati Adaptation Programme. Phase II: High Intensity Rainfall and Drought. NIWA Client Report: WLG2008 – 12, NIWA Project GOK 08201.

Nunn, P., 2009: Responding to the challenges of climate change in the Pacific Islands: management and technological imperatives, Climate Research, 40, 211–231.

Pérez, A., Fernandez, H. and C. Gatti, 2010: Building Resilience to Climate Change: Ecosystem-based adaptation and lessons from the field. International Union for Conservation of Nature and Natural Resources (UUCN), Gland, Switzerland, 164pp.

Pernetta, J.C., 1988: Projected climate change and sea level rise: a relative impact rating for the countries of the Pacific Basin. In Potential Impacts of Greenhouse Gas Generated Climatic Change and Projected Sea-Level Rise on Pacific Island States of the SPREP Region, Association of South Pacific Environmental Institutions (ASPEI) (ed.). Prepared for the MEDU Joint Meeting of the Task Team on Implications of Climatic Change in the Mediterranean, Split, Yugoslavia, October, 1988, 1-11.

Petrini, K., 2010a: Preliminary Lessons Learned. UNDP-GEF Small Grants Programme, Apia, Samoa, 1p.

Petrini, K., 2010b: UNDP GEF CBA in Samoa Results. UNDP-GEF Small Grants Programme, Apia, Samoa, 2pp.

Reid, H., Alam, M., Berger, R., Cannon, T., Huq, S. and A. Milligan, 2009: Community-based adaptation to climate change: an overview. Participatory Learning and Action 60, International Institute for Environment and Development (IIED), London, U.K, 11-33pp.

Sikivou, M., Pelesikoti, N., Lal, P., Mendani, R., Jiwanji, M. and H. Timmermans, 2009: Guide to Developing National Action Plans. Community Risk Programme, Pacific Islands Applied Geoscience Commission (SOPAC), Suva, Fiji, 76pp.

SOPAC (No Date): Comprehensive Hazard and Risk Management: Guidelines for Pacific Island Countries, CHARM Manual. South Pacific Applied Geoscience Commission (SOPAC) Suva, Fiji.

SOPAC, 2005: Disaster Risk Reduction and Disaster Management (DRM) Framework for Action 2005 – 2015: An Investment for Sustainable Development in the Pacific Island Countries. Pacific Islands Applied Geosciences Commission (SOPAC), Suva, Fiji, 34pp.

SOPAC, 2009: Implementation of the Hyogo Framework for Action and the Pacific Disaster Risk Reduction and Disaster Management Framework for Action 2005 – 2015; Report for the period 2007 – 2009. Regional Synthesis Progress Report. SOPAC Miscellaneous Report 674, 52pp.

SOPAC, 2010: Mid-Term Review, Pacific Regional DRM Framework for Action, Regional Consultations of 13 April and 13 August 2010. Pacific Islands Applied Geosciences Commission (SOPAC), Suva, Fiji, 34pp.

SPREP, 2006: Pacific Islands Framework for Action on Climate Change 2006-2015. Secretariat for the Pacific Regional Environment Programme (SPREP), Apia, Samoa, 26pp.

Sutherland, K., Smit, B., Wulf, V., and T. Nakalevu, 2005: Vulnerability in Samoa. Tiempo, 54, 11-15.

UNDP, 2006: Local Level Risk Management. Bureau of Crisis Prevention and Recovery, United Nations Development Programme (UNDP), New York, 21pp.

UNDP, 2010: Handbook for Conducting Technology Needs Assessment for Climate Change. United Nations Development Programme, New York, 176pp.

UNEP, 2010: Using Ecosystems to Address Climate Change – Ecosystem Based Adaptation. Information Series, Regional Seas Programme, Marine and Coastal Ecosystems Branch, Division of Environmental Policy Implementation, United Nations Environment Programme (UNEP), Nairobi, Kenya, 8pp.

UNFCCC Secretariat, 2005: Handbook on Vulnerability and Adaptation Assessment. United Nations Framework Convention on Climate Change (UNFCCC), Bonn, Germany.

UNISDR, 2010: Local Governments and Disaster Risk Reduction: Good Practices and Lessons Learned. United Nations Secretariat of the International Strategy for Disaster Reduction (UNISDR), Geneva, Switzerland, 86pp.

Vincent, K., Wanjiru, L., Aubry, A., Mershon, A., Nyandiga, C., Cull, T and K. Banda, 2010: Gender, Climate Change and Community-Based Adaptation. United Nations Development Programme, New York, 80pp.

Warrick, O., 2007: Development, forest conservation and adaptation to climate change: A case for integrated community-based sustainability in rural Vanuatu. In Proceedings, the Australian New Zealand Society for Ecological Economics Conference “Reinventing Sustainability: a Climate for Change”, Queensland, Australia, 3-6 July 2007.

Warrick, O., 2009: Ethics and methods in research for community-based adaptation: reflections from rural Vanuatu. Participatory Learning and Action, 60, pp. 76-87

Warrick, O., 2010: Climate change and social change: vulnerability and adaptation in rural Vanuatu.(in preparation, manuscript available from author, School of Social Sciences, University of Waikato)

Warrick, R.A., 2006: Climate Change Impacts and Adaptation in the Pacific: Recent Breakthroughs in Concept and Practice. In Chapman, R., Boston, J. and Schwass, M. (eds) Confronting Climate Change: Critical Issues for New Zealand. Wellington: Victoria University Press, 189-196.

Warrick, R.A., 2009: From CLIMPACTS to SimCLIM: The development of an integrated model for assessing impacts and adaptation to climate change. In: C.G. Knight and J. Jaeger (eds.), *Integrated Regional Assessment: Challenges and Case Studies.* Cambridge University Press, Cambridge, UK., 280-311.

Warrick, R.A., W. Ye, P. Kouwenhoven, J.E. Hay and C. Cheatham, 2005: New Developments of the SimCLIM Model for Simulating Adaptation to Risks Arising from Climate Variability and Change. In Zerger, A. and Argent, R.M. (eds) *MODSIM 2005.* International Congress on Modelling and Simulation. Modelling and Simulation Society of Australia and New Zealand, December 2005, pp. 170-176.

World Bank, 2009: Convenient Solutions to an Inconvenient Truth: Ecosystem- based Approaches to Climate Change. World Bank, Washington, D.C, 91pp.

World Bank, 2010: Pacific Catastrophe Risk Financing Initiative, Phase 2 (PCRFI2), World Bank, Washington D.C, U.S.A.

WWF South Pacific Programme, 2009: Climate Witness: Community Toolkit. WWF South Pacific, Suva, Fiji, 18pp.

Annex 1

Methods and Sources of Information

The findings in this discussion paper are based on both the relevant literature and the understanding and expert judgement of practitioners and other key informants who have accumulated considerable experience as a result of undertaking and utilising vulnerability and adaptation assessments. This includes the development of lessons learned and identification of gaps in information and understanding as well as success stories and factors.

To be identified as a successful assessment approach, method or tool required evidence of the approach, method or tool: (i) being replicated/upscaled; (ii) making a critical contribution to reducing vulnerabilities/risks; and (iii) being used to inform the development of another successful approach, method or tool.

Assessment approaches identified as being “best suited to the region” were selected because: (i) they conform to the principles that the present study has developed to assist in harmonising understanding and action; (ii) the associated methods and tools have a history of successful use globally as well as in the region; (iii) they have also evolved to better suit regional circumstances, in part based on lessons learned; and (iv) there is a rapidly growing capacity at regional, national and community levels to apply these approaches.

Annex 2

A Review of Assessment Approaches, Methods and Tools Used in the Pacific

Impact and Vulnerability Assessments. Preliminary national impact assessments[2] and derivation of "susceptibility indices" dominated the late 1980s. These were followed in the early 1990s by ten field and desk-top scoping studies conducted at national level. None used the Intergovernmental Panel on Climate Change (IPCC) Common Methodology for Vulnerability Assessment (IPCC, 1991). Some reports did not even specify the changes in climate and sea level assumed in the study. However, also in the early 1990s the Common Methodology developed by the IPCC was used in separate vulnerability assessments for: Tongatapu, Tonga; Kiribati; Majuro Atoll, Marshall Islands; and Moorea, French Polynesia. The relatively detailed guidance for the Common Methodology was seen as a positive attribute by many of those who had conducted the assessments. However, the expectation that assessments could be completed relatively quickly was not met and difficulties were experienced with its biophysical framework, the cost-benefit orientation of analyses of response options as well as differences from country to country in the importance given to climate change at the political and other levels.

As a response to these difficulties a broader assessment and decision-making support framework appropriate to the Pacific, and even more widely applicable, was developed. The Stress-Response Methodology (SRM) for the Assessment of Vulnerability and Resilience to Sea-Level Rise and Climate Change was described initially by Kay and Hay (1993), who argued that an "optimal response" to climate change by Pacific island countries (PICs) should be one that would enhance the resilience and decrease the vulnerability of both environmental and socio-economic systems. However, when the methodology was used in vulnerability and resilience assessments in Fiji, Samoa and Tuvalu several shortcomings became evident. These included the subjectivity in assigning vulnerability and resilience scores to individual coastal system components, and the difficulty of quantifying intrinsic values and valuing elements of subsistence societies. These had always been problematic for PICs.

Index-based Assessments. Building on the early work of Pernetta (1988), who developed a relative index of susceptibility to climate change and sea-level rise and applied it to PICs. In his assessment of the effects of increased temperature, McGregor (1988) used the Relative Strain Index (RSI) as an index of human comfort. The index is the ratio of the amount of sweat evaporation needed for comfort to the amount of evaporation possible. Discomfort is experienced when the ratio exceeds 0.3. McGregor undertook the study for a number of coastal centres throughout Papua New Guinea. He based his calculations on an assumed 2 C temperature increase and a 7% vapour pressure increase over current conditions. He also used the observed mean annual environmental lapse rate to determine at what altitude in Papua New Guinea temperature regimes would be similar to those presently experienced at coastal locations. The thermal comfort analyses based on the RSI were extended to the western tropical Pacific in McGregor (1990).

A more complex index, the Environmental Vulnerability Index (EVI), was developed by Kaly et al. (1999). It was designed for small island states, and particularly those for which data availability is limited. However, the EVI never gained wide acceptance as a tool, since national comparisons were compromised by variations in data availability and quality.

[2] The assumed future climate was either unstated, or based on very limited climate science.

Hazard Assessment and Risk Management. In the mid 1990s, Guidelines for Comprehensive Hazard Assessment and Risk Management (CHARM) were developed in an attempt to overcome the Pacific's vulnerability to the effects of natural hazards, environmental damage and other threats. The Guidelines were designed to move the hazard and risk management approach away from solely being response and relief oriented toward a more holistic risk management strategy linked intrinsically to national development planning. Since CHARM was designed to assist decision making in disaster risk reduction and disaster management planning, a key activity has been to assist PICs to review their disaster risk management arrangements and to strengthen relevant policies and institutions. This top-down approach may have reduced the effort given to community-based disaster risk management (CBDRM). However, more recently, Papua New Guinea has addressed this issue by integrating CHARM with community-based vulnerability assessment approaches.

Locally Focused Assessments and Adaptation. Community-based adaptation (CBA) has received considerable attention in more recent years, in the Pacific as well as globally. Its culturally appropriate strategies and mechanisms have proved to be effective in harmonising human development and efforts to manage climate change. It not only facilitates adaptation but is designed to also accelerate socio-economic progress, thus contributing to sustainable human development at the grassroots level. A key factor driving the development of community-focused assessment methodologies in the Pacific is that, in general, communities own and manage most of the resources and other assets at risk from climate change. The low capacity in PICs to produce, acquire and utilise the high resolution climate model outputs required for top-down, scenario-driven assessments is also resulting in greater focus on CBA.

The Capacity Building for the Development of Adaptation Measures in Pacific Island Countries (CBDAMPIC) project is considered to be the first comprehensive initiative to result in tangible adaptation in the Pacific (Nakalevu et al., 2006a). Between 2002 and 2005 it funded sixteen pilot CBA projects in four PICs. It developed and applied the Community Vulnerability and Adaptation Assessment and Action Methodology (CV&A). The Methodology built on various participatory approaches that had already been used in the Pacific, including CHARM, rapid rural appraisal, and participatory learning and action. The methodology begins by documenting the current exposure and current capacity of the community to cope with climate change. The ultimate objective is to identify opportunities to strengthen the adaptive capacity of communities to climate change. The engagement of local stakeholders is encouraged at each stage of the assessment process. This approach was actively promoted as most Pacific Islands lacked the climate modelling and scenario generating capacity necessary for detailed climate change impacts studies.

Subsequently the University of the South Pacific developed and applied an Integrated Assessment and Action Methodology (IAAM) for Climate Change, Disaster Risk Management and Sustainable Development, a tool for V&A assessment based on an approach to adaptation planning and implementation that integrates both climatic and non-climatic factors. The methodology evolved from the CV&A methodology developed under the CBDAMPIC project. It also draws on other guides and tools such as the WWF Climate Witness Toolkit, which includes an education and awareness component based on knowledge held by men and women in PIC communities about the impacts that changes in climate are having upon their fragile ecosystems, the Local Management of Marine Areas Methodology, the United Nations Development Programme (UNDP) Adaptation Policy Framework and the CHARM methodology.

IAAM assesses both vulnerability and possible adaptation options through both community-based approaches using participatory tools and facilitator-based approaches using rigorous scientific tools and methods. Critically, the assessment and the plans are based on a firm understanding of the socio-economic, cultural and environmental problems currently faced by the community. They integrate climatic considerations into a broader framework of sustainable development, as perceived by the community. Significant problems related to climate extremes presently faced by the community are addressed first, since building resilience to these, through disaster risk reduction, also increases resilience to longer-term climate change (Limalevu and Weir, 2005). The recently commenced Pacific Adaptation to Climate Change (PACC) Project has adopted an action framework that fuses national mainstreaming and community-based approaches, using IAAM.

In 2004 the Global Environment Facility (GEF) established the Strategic Priority on Adaptation (SPA), which in part supports CBA. This has the goal of reducing vulnerability and increasing adaptive capacity to the adverse effects of climate change, while generating global environmental benefits, building resilience of communities and eco-systems and resource-dependent livelihoods in the face of climate change. The Mekong-Asia Pacific – CBA programme and the GEF-UNDP Small Grants Programme are now implementing CBA in 16 Pacific island countries and territories. The Vulnerability Reduction Assessment (VRA) methodology is being used by these Programmes. It is a participatory impact assessment tool of common-unit indicators that can be used to determine community perceptions of climate risk and adaptive capacity before, during and after project implementation, making it possible to determine if a project is successful or unsuccessful in reducing climate change risks. The VRA comprises four indicators based on the UNDP Adaptation Policy Framework.

Ecosystem-based adaptation (EBA) complements and supports CBA by giving special attention to those ecosystem services that underpin human well-being but which could be compromised by climate change. In this way the sustainable use of biodiversity and ecosystem services become an important part of a comprehensive adaptation strategy. In the Pacific EBA has not been widely developed as a distinctive methodology or approach. Rather, and consistent with a more holistic approach that is most relevant to the Pacific, it is often subsumed in CBA, RBA and other approaches. Fiji is one of the more proactive PICs, with EBA being applied in marine and coastal initiatives utilising conservation mechanisms such as marine protected areas (Fiji Locally Managed Marine Area [LMMA] networks and the Vatu-i-Ra Heritage Seascape Project), mangrove rehabilitation (e.g. along the Coral Coast), Integrated Coastal Zone Management (e.g. in Natadola), with a small number of programmes focusing on watershed protection and water purification (e.g. Sovi Basin, which is one of the largest watersheds in Fiji and the source of three major rivers – Nadi, Rewa and Ba). Recent research also calls for Ecosystem-Based Management to be applied in rivers and terrestrial systems in Fiji rivers, but from the perspective of species conservation, not climate change adaptation. Chandra and Dalton (2010) conclude that EBA has not been popular in Fiji, largely due to a lack of understanding on the practicality of the approach and shared vision amongst stakeholders on the recognition and value of ecosystem services. Although ecosystem-based management approaches may lead to the better management of floods in Fiji, successful implementation depends on improved understanding and stakeholder acceptance. A framework to integrate multi-level scientific knowledge about ecosystems and the services they provide matched to stakeholder preferences is needed.

The International Federation of Red Cross/Red Crescent is using Vulnerability and Capacity Assessment (VCA), a set of tools that help communities assess and

address the risks they are facing. The methodology which has been tried and tested globally in many countries, including Fiji, Samoa and the Solomon Islands. The first stage involves national society support to understand the reasons for undertaking a VCA, sensitising stakeholders, and establishing the objectives and management structure for the VCA. The second stage moves from assessment to planning, and includes using investigation tools with the community, systematising, analysing and interpreting data and returning information to the community in order to decide priorities and actions. The final level moves from planning to action and includes turning vulnerabilities into capacities through practical actions, undertaking risk reduction activities in the community, and preparing recommendations and reports.

Community-based Risk Screening – Adaptation and Livelihoods (CRiSTAL) is intended to assist project planner and managers with integrating risk reduction and climate change adaptation into community-level projects. The tool helps users to systematically understand the links between climate change and local livelihoods. It also enables users to assess a project's impact on community level adaptive capacity while also assisting users to make adjustments to improve a project's impact on adaptive capacity. The tool has proved to be useful in highlighting the relevant climate change vulnerabilities regarding livelihood resources, and ways to adapt which are relevant to their specific work (Gero et al., 2010).

Integrated Assessments. Integrated assessments, and the tools to support them, are of particular relevance to PICs because of the numerous and well-developed interactions between the natural and human systems of island countries. These interactions are typically too complex to be reflected appropriately in manual assessments. In the Pacific, SimCLIM and its generic predecessor, VandaCLIM, have been used to link and integrate complex arrays of data and models in order to simulate, spatially and for current and possible future conditions, the bio-physical impacts and socio-economic consequences of climatic variations, including extreme climate and weather events (Warrick, 2009; Warrick et al., 2005). Over the past decade, important improvements to SimCLIM have included movement to an open architecture that facilitates the importing of user-specific information, the ability to provide more explicit consideration of demographic, land use and infrastructure patterns and changes and of adaptation options, incorporation of relatively simple economic tools, and the ability to run the models year-by-year rather than for a given time (e.g. 1990 or 2050). This ability to run models in transient mode provides the potential for superimposing the variability (including extremes) of climate (and/or sea level) on the change in mean conditions over time, allowing improved quantification of impacts and assessment of adaptation options (Warrick, 2006).

Risk-based Approaches. Quantitative risk assessments have the advantage of not only showing how risk levels change for given emission or other scenarios, thus highlighting the trade off between mitigation and adaptation, but also provide a way to distinguish between the risks attributable to present, natural climatic variations and extremes and those associated with future greenhouse-gas-induced changes in climate. Furthermore, risk assessment and management are common to many sectors – e.g., health, financial, transport, agriculture, energy, and water resources. The existing familiarity of planners and decision makers with risk management therefore helps facilitate the mainstreaming of risk-based assessments and responses.

Risk-based climate assessments have been shown to provide a more direct functional link between assessing vulnerability and identification and prioritization management interventions (i.e. adaptation) designed to reduce anticipated consequences to tolerable levels. They have thus helped overcome the practical disconnect that typify other V&A assessment methodologies, such as CV&A and the IPCC Guidelines for Assessing

Climate Change Impacts and Adaptation Responses which have been widely used by PICs, including when preparing their First National Communications to the United Nations Framework Convention Climate Change (UNFCCC) (ADB, 2005; Warrick, 2006).

The first risk-based climate assessment in the Pacific appears to have been undertaken by Jones et al. (1999). They determined risks related to sea-level rise and coral reefs for global emissions scenarios with and without implementation of the Kyoto Protocol. GHD and SEA (2005) derived detailed coastal protection design criteria for part of Rarotonga, Cook Islands, based on reef flat water levels and wave heights. These were calculated using a Monte Carlo modelling process for cyclones in the area and translation of the effects of these cyclones on the coastline. Using this approach design conditions can be assigned a statistical return period or average recurrence interval. The process combines the variability inherent in cyclone effects including: intensity of the cyclone; direction and travel speed of the cyclone; spatial extent of the extreme winds and waves; and closest approach distance and relative location of cyclone path.

Case studies that demonstrated a risk-based approach to adaptation in the Cook Islands and the Federated States of Micronesia (ADB, 2005), highlighted that in the Pacific, as elsewhere, climate change will manifest largely as changes in the frequency and consequences of extreme events and inter-annual and similar variations, rather than as long-term trends in average conditions.

The Kiribati Adaptation Project has demonstrated how a regional climate model can be used to generate information that will better inform local understanding of the potential changes in climate extremes such as the incidence of droughts and extreme rainfall events. This included determining return periods (average recurrence interval) of 24-hour rainfall events for selected locations in Kiribati, for the current climate and for the projected climate for a mid-range temperature scenario for the 2090s (NIWA, 2008). While a major task, is does demonstrate the benefits of building on Australian and New Zealand modelling expertise. This represents an important opportunity to reduce the current high levels of uncertainty in climate change projections for Pacific island countries.

The UNDP Adaptation Policy Framework (APF) (Lim et al., 2004) provides guidance on risk-based identification of appropriate adaptation strategies, policies and measures. Depending on the level of knowledge about the vulnerable system, the actual approach can vary widely from one project to the next. The APF is comprised of five components: scoping and designing an adaptation project; assessing the current vulnerability; assessing future climate risks; formulating an adaptation strategy in response to current vulnerability and future climate risks; and continuing the adaptation process by implementing, monitoring, evaluating, improving and sustaining the initiatives launched by the adaptation project. Elrick and Kay (2009a) used a similar strategic, top-down risk management framework when identifying appropriate ways to manage coastal climate change risks in Kiribati. It had the five phases of conventional risk management as used in the APF: set the context; risk identification; risk analysis; risk evaluation; and risk treatment. Risk treatment and adaptation were considered synonymous. The outputs from the risk analysis informed selection of a broad range of adaptation options that could be implemented to treat the identified risks. Subsequently, the applicability of each adaptation option was assessed to inform the decision making process. Finally, a relevant series of implementation measures were selected along with an assignment of responsibility for implementing each measure.

Climate risk profiles prepared for ten PICs quantify the current and anticipated levels of climate-related risks (e.g. high rainfall events, drought, high sea levels, strong

winds, and high air temperatures). These risk profiles provide the fundamental climate data for adaptation initiatives for various development sectors (ADB, 2010). The regional PACC Project is identifying and addressing the risks posed by climate change through pilot scale adaptation in the coastal management, food security and water resources sectors. Technical assistance for developing capacities for integrating risks into management decision-making processes at the national, sub-national and project levels is also being undertaken (Hay, 2009b).

Two major challenges with the application of risk-based approaches are now being overcome, albeit slowly in the Pacific. The first relates to the difficulty of accessing and making appropriate use of climate scenarios with suitably high resolution and certainty. Information technologies are now making it possible for PICs to access down-scaled outputs of global and regional climate models. The other challenge, not restricted to risk-based approaches, is adequate characterization of the elements exposed to adverse weather and climate conditions, currently and in the future. Several initiatives have been undertaken to address this challenge in the Pacific (e.g. Air Worldwide Corporation, 2008), and more are underway (e.g. World Bank, 2010; SOPAC, 2010).

Gender Dimensions of Climate Change Vulnerability and Adaptation Assessments. Climate change is exacerbating existing gender inequality, and will continue to do so unless addressed with gender-sensitive approaches. Poor women's limited access to resources, restricted rights, limited mobility and voice in community and household decision-making can make them much more vulnerable than men to the effects of climate change. Climate change may even erode progress that has been made towards gender equality in many developing countries. However, on average, women are more inclined towards pro-environmental behaviour, such as taking part in citizen and community actions. Thus the inclusion of women in locally focused assessments and adaptation is essential not only because women are especially vulnerable, but also because they can be valuable contributors to adaptation work. The inclusion of women ensures that their valuable knowledge and skills of adaptation are not excluded (Haigh and Vallely, 2010; UNDP, 2010).

Addressing gender considerations includes the process of assessing the implications for women and men of any planned action, including legislation, policies or programmes, in all areas and at all levels. It involves making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring and evaluation of policies and programmes in all political, economic and societal spheres so that women and men benefit equally and inequality is not perpetuated. UNDP (2010) provides a summary of analytical tools that can be used for gender mainstreaming, along with principles for sound and gender-sensitive participation based on UNDP-GEF CBA project experiences.

In the Pacific, traditional structures provide the most effective entry point for implementing gender issues. Traditional institutions and structures should therefore be factored into V&A assessments. Experience has shown that the CV&A approach facilitates consultation with community organizations and vulnerable groups such as women, children and elders of the community, while using a resilience-based approach directs focus on socio-economic issues in relation to the whole-island but gender issues such as gender rights are not taken into consideration. A "rights-based approach" considers gender rights, with the implication in an adaptation context being recognising the economic, social and cultural rights of groups such as women and youth and strengthening the relationship between groups with valid claims and those with obligations (Anderson, 2008).

Evidence from Samoa's UNDP-GEF CBA programme highlights that women are indispensable partners for cooperating and making things happen. They are accustomed to working together for a common goal, voluntarily dedicating time for their households, sacrificing personal agendas for the wellbeing of the whole community, and caring for the most vulnerable groups, such as children and persons with disabilities. Moreover, women are important players in the CBA implementation team itself because some community members sometimes feel less embarrassed in front of women who, as a complement to men's technical skills, have developed particular skills in building confidence and managing emotions. When supported and empowered, women are confident and active participants, raising their voices, sharing their own perspectives and generously passing on their expertise, skills, and time (UNDP, 2010).

Incorporation of Traditional Knowledge and Technologies in Assessments. In the Pacific, there is a view that traditional solutions to environmental problems are the key to sustainable human–environment interactions in such societies. Yet Nunn (2009) reports that memories concerned with shoreline protection in PICs consistently fail to report anything that could be helpful in the modern context. Relocation was evidently the preferred adaptation option until the 20th century in most parts of the Pacific. However, archaeological investigations in parts of the Pacific suggest that, in especially vulnerable locations, climate change led to significant human modifications of refuge environments.

Campbell (2006) provides what is arguably the most comprehensive assessment of traditional disaster reduction in PIC communities. He found a wide range of traditional measures that enabled them to ameliorate the effects of natural disasters, with four clusters of coping measures – food security, intercommunity and intra-community cooperation, damage reducing features of buildings and traditional knowledge systems.

Technology Assessments and Transfer. Most PICs have assessed their technology needs for meeting the climate change challenge. They have followed a systematic approach that is used to identify, evaluate, and prioritise technological means for achieving sustainable development, increasing resilience to climate change and avoiding dangerous anthropogenic climate change. Guidance for the assessments was provided by a handbook jointly developed by UNDP and the UNFCCC Secretariat (UNDP, 2010), or by an earlier version published in 2004.

When assessing such needs it is important that the technologies selected are clearly in line with the countries' development strategies. Without consideration of development priorities in host countries there will not be sustainable transfer of technologies or proper use of limited resources. Therefore the first step in the assessment is to describe the national development needs and priorities, reflecting long-term economic and social trends, before moving to the actual technology assessment. When generating plans and strategies for the future for address climate change, and to ensure maximum development benefits, climatic changes already observed and possible changes in the future need to be taken into account. An assessment based only on current climate conditions is liable to fail to prioritise the relevant sectors affected by future climatic changes and the corresponding technology needs. Thus the assessment makes full use of national vulnerability and/or resilience profiles with regard to future climate change impacts.

Assessments Related to UNFCCC and Related Processes. UNFCCC processes have influenced the approaches to V&A studies in the Pacific. In addition to technology needs assessments (see above), these include:

- Preparation of National Communications – the V&A assessments that were reported in the first national communications followed the IPCC Guidelines for Assessing Climate Change Impacts and Adaptation Responses (see comment above) while the V&A assessments for the second national communications are using a wide variety of tools such as SimCLIM, CV&A, IAAM, VRA, APF and VCA, often in combination; this change in methodologies is consistent with UNFCCC guidance that states: "Non-Annex I Parties are encouraged to use, for the evaluation of adaptation strategies and measures, appropriate methodologies they consider better able to reflect their national situation, provided that these methodologies are consistent, transparent and well documented" (UNFCCC Secretariat, 2003);
- National Adaptation Programmes of Action (NAPAs) – as Least Developed Countries, five PICs (Kiribati, Solomon Islands, Tuvalu, Samoa and Vanuatu) have received funding to prepare a NAPA; this lays out a plan of action about how to build capacity to adapt to climate change and how to enhance coping strategies to adverse impacts of climate and climate change; the NAPA is an action plan prepared using mostly bottom-up participatory methods. These are designed to ensure it has broad acceptance and is action-oriented; there are nine steps involved in its preparation, the last being submission of the NAPA (LDC Expert Group, 2009a); this has proven problematic as there is no automatic progression to implementation; however, the process leading to the preparation of a NAPA has been found to be a successful way to integrate adaptation into national development plans; selection of the NAPA priority projects is generally consistent with national poverty reduction goals, while the completed National Communications to the UNFCCC, along with the NAPAs, have allowed planning decisions to be based on a sound knowledge of climate change and its potential impacts; success of the NAPAs has resulted in many other PICs preparing a national adaptation plan, or similar; they often take the opportunity to include both disaster risk reduction and adaptation in the planning, with some countries taking an even more integrated approach by including mitigation as well;
- National Capacity Self Assessments (NCSAs)– given that vulnerability is strongly influenced by adaptive capacity, these assessment are highly relevant; NCSAs have been undertaken by PICs, with funding provided by the UNFCCC through the GEF; NCSAs identify country level priorities and needs for capacity to address global environmental issues, and biodiversity, climate change and land degradation in particular; they also provide an opportunity to identify critical capacity constraints, including the broader implications for national governance; there are five steps, with again the last step being to prepare a capacity development plan; again this has proven problematic, as there is no guaranteed progression to addressing the identified capacity constraints; and
- Nairobi Work Programme (NWP) – the objectives of the NWP are to assist countries to improve the understanding and assessment of climate change impacts, V&A and also to make informed adaptation decisions; building on its success in its first phase, the NWP is conducting a large range of activities in its second phase with particular emphasis on activities related to adaptation planning and practices, and to economic diversification; there is thus a strong link between the NWP and the advancement of adaptation planning (including disaster risk reduction), no more so than in the Pacific.

Annex 3

Analysis of Frameworks, Approaches and Methods Relevant to Vulnerability and Adaptation Assessments

Category	From (in Pacific)	Name	Abbrev-iation	Key References	Intended Uses	Implementation	Findings and Examples	Strengths & Limitations
Framework	Mid 2000s	Pacific Islands Framework for Action on Climate Change 2006 - 2015	PIFACC	SPREP (2006) Hay (2010)	Facilitate building capacity of Pacific island peoples and communities to be resilient to the risks and impacts of climate change	PIFACC provides a regional mandate and an 'entry point' for taking action at the regional level that supports subsequent implementation at the national level to address climate change	The Pacific Island Forum Secretariat requires that any bi-lateral agreements between it and a development partner are consistent with the PIFACC; some countries have used the PIFACC to guide preparation of national policies	PIFACC is seldom used proactively at country level as a guidance document during project planning and related discussions; most government officials do not see the relevance of the PIFACC to national level activities
	Mid 2000s	Pacific Disaster Risk Reduction and Disaster Management Framework for Action 2005-2015	PRDRM-FA	SOPAC (2005) SOPAC (2010)	Facilitate building the capacity of Pacific island communities to accelerate the implementation of disaster risk management	The Pacific Platform for Disaster Risk Reduction and Disaster Management was established in 2009, to support the development and implementation of national action plans for PICs	The Framework has contributed to improved levels of preparedness for some types of disasters, in particular events that allow for a reasonable warning time; preparedness for sudden-onset disasters is less developed; the approach to disaster risk management is still considered to be largely focused on disaster events	Successful implementation requires collaboration of government agencies and/or strong partnerships with community organisations and/or civil society organis-ations; the main barrier preventing the Framework from achieving its intended outcome is disaster risk management still not consistently reflected in all PICs national development strategies

Category	From (in Pacific)	Name	Abbrev-iation	Key References	Intended Uses	Implementation	Findings and Examples	Strengths & Limitations
							rather than on addressing underlying risk	
	Mid 2000s	Adaptation Policy Framework	APF	Lim and Spanger-Siegfried (2004) Petrini (2010b) Elrick and Kay (2009a)	Provides a flexible approach through which users can clarify their own priority issues and implement responsive adaptation strategies, policies and measures	The APF is highlighted in guidance such as that related to preparation of National Communications to the UNFCCC as it can assist in the identification of potential adaptation options, strategies and measures	CBA projects in Samoa use the VRA methodology which is based on the APF's key steps for designing adaptation projects; the APF's five phases of conventional risk management have been used to identify appropriate ways to manage coastal climate change risks in Kiribati	Recognises that adaptation to short-term climate variability and extreme events lays the foundation for reducing vulnerability to longer-term climate change; adaptation policy and measures are assessed in a development context; the APF itself has not had wide uptake in the Pacific, but it has influenced approaches and methods
Approach	1990s on	Scenario Driven Approach	SDA	Malone (2004) Lu (2006) Nakalevu (2006a)	To identify changes in climate and thus inform assessments of the potential impacts of climate change on natural and human systems	Development, documentation and application of climate scenarios are an important aspect of the preparation of national communic-ations, mainly as part of V&A assessments; however, these have been hindered by a severe lack of quality data, capacity and resources	Used in vulnerability assessments for: Tongatapu, Tonga; Kiribati; Majuro Atoll, Marshall Islands; and Moorea, French Polynesia as well as in the V&A assessments conducted for PIC Initial National Communications to the UNFCCC	Nearly all PICs lack the capacity to run the relevant models to produce climate scenarios; the approach does not analyse actual coping and adaptation processes and is not structured to contribute to capacity building
	Early 2000s	Sectoral Assessment Approach	SAA	Feenstra (1998) Government of Samoa (2008,	To identify impacts on specific sectors as well as	Increased emphasis on SAA as sectoral impacts of climate	Samoa used the SSA in preparing its NAPA as well as its	While still usually national level, the assessment makes

Category	From (in Pacific)	Name	Abbrev-iation	Key References	Intended Uses	Implementation	Findings and Examples	Strengths & Limitations
				2010)	adaptation options	change became more evident, and as modelling capacities improved; NAPA preparation also encouraged SAAs	Second National Communication to the UNFCCC	increased use of sub-national information and expertise; top-down, scenario methods are often used, which is problematic in the Pacific; failure to consider sector linkages can lead to mal-adaptation
	1999	Risk Assessment Approach	RAA	Jones et al. (1999) Heitzmann et al. (2002) Carter at al. (2007) Heltberg et al. (2008) Government of Samoa (2010)	The RAA can be used to assess current adaptations to climate variability and extremes before assessing adaptive responses to future climate as well as for assessing the limits of adaptation and linking adaptation to sustainable development, engaging stakeholders	In the Pacific, RAA was used as early as 1999 when the risks related to sea-level rise and coral reefs were determined for selected global emissions scenarios; with the recognition that climate change will first manifest as increases in weather and climate extremes, the RAA has had increasing use and given rise to several methods and tools	Climate risk profiles have been prepared for ten PICs; they have been used in preparation of ADB's Climate Change Implementation Plan for the Pacific and in many V&A assessments (e.g. Samoa)	The RAA is now preferred to the SDA given the certainty that some climate change will occur (and is already occurring); it can contribute to decision-making under uncertainty and also provides a mechanism for incorporating other sources of risk; a risk-based approach does not in itself require complex, scenario-based risk characterization activities; the RAA needs to be integrated with and assessment of risk reduction options (e.g. RBA)
	Late 1990s	Community-based Disaster Risk	CBDRM	SOPAC (2005) SOPAC (2010)	To empower communities to be able to self organise	Participatory approaches are being applied in many PIC	Across the region the Pacific Red Cross Movement is	CBDRM projects in the Pacific are often carried out as isolated

Category	From (in Pacific)	Name	Abbrev-iation	Key References	Intended Uses	Implementation	Findings and Examples	Strengths & Limitations
		Management			to prepare for, and manage disasters and to build risk reduction measures into daily development activities	communities to identify specific disaster risk management initiatives that can result in increased safety and resilience to hazards; this includes carrying out assessments of key development risks specific to the community and identifying key issues relating to these aspects of risk	undertaking assessments of disaster risks and of community vulnerabilities, including the capacity to manage disaster risks; the Foundation of Peoples of the South Pacific is also involved in community based disaster risk assessments – it is working with communities in Tuvalu and Samoa to develop community based disaster risk reduction and disaster risk management plans / safer village plans	initiatives; while they may generate a considerable repertoire of good practices and research, these are rarely shared and used across the wider regional network of PICs and partners; many CBDRM projects claim to work at higher levels, but actually do not engage effectively with local government
	Early 2000s	Risk-based Adaptation	RBA	ADB, 2005	To manage both the current and future risks associated with the full spectrum of atmospheric and oceanic hazards.	Involves: (i) assessments of both the risks arising from current climate variability and extremes and from future, incremental changes in those risks that will result from longer-term changes in climate; and (ii) assessments	"Climate proofing" a coastal community in Pohnpei and a roading infrastruct-ure project in Kosrae (both in the Federated States of Micronesia), the design of the breakwater for the newly developed Western Basin of	Assessments combine both the likelihood and consequence components of climate-related impacts and can assess risks for both current and anticip-ated conditions, with the option of examining either specific events or an

Category	From (in Pacific)	Name	Abbrev-iation	Key References	Intended Uses	Implementation	Findings and Examples	Strengths & Limitations
						of adaptation strategies and specific interventions that can be used to reduce unacceptable risks, including analyses of their benefits and costs	Avatiu Harbour, Rarotonga, and a community inland from Avatiu Harbour (both in the Cook Islands	integration of those events over time; risk-based methods also facilitate an objective and more quantitative approach, including cost benefit analyses
	Early 2000s	Community-based Adaptation	CBA	Ayers and Huq, (2009) Reid et al. (2009) Limalevu (2010) Gero et al. (2010) Vincent et al. (2010)	CBA is an evolving approach that supports tangible climate change adaptation driven by local actors; its goal is to empower people to plan for and cope with the impacts of climate change, while recognising that interventions focusing only on climate-related risks are unlikely to reflect community priorities; despite variations of form, all CBA recognises the need for context-specific adaptation projects that identify local vulnerabilities, draw upon local knowledge and capacity, improve local adaptive	participatory approaches and methods developed in both disaster risk reduction and community development work, as well as sector-specific approaches; it starts with a communities' expressed needs and perceptions, and delivers poverty reduction and livelihood benefits, as well as enhancing adaptive capacity and hence reducing vulnerability to climate change and disasters; the best CBA projects combine local and scientific knowledge	In Samoa VCA is being used to assess the specific vulnerabilities of the individual villages and develop targeted responses to educate people in ways to overcome and become more aware of the risks in their daily lives; in Navua, Fiji, adaptive capacity is being assessed and enhanced using LLRM, including with respect to disaster risk sensitive development projects	Many agencies are now working with local communities to identify not only climate-related risks, but also factors that make people vulnerable to those risks; this is leading to community-driven initiatives that help build adaptive capac-ity in the more vulnerable commun-ities; lessons learned need to be consolidated and shared in order to replicate and scale up CBA, and the approach and findings relevant to larger-scale adaptation policy making, without compromising the participatory and community-driven nature of the approach

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					capacity, and directly involve local stakeholders.			
	Early 2000s	Gender Sensitive Approach	GSA	Vincent et al. (2010) Lane and McNaught (2009)	To ensure that gender equity considerations, as well as men's and women's different needs, perspectives and knowledge, are taken into account when planning adaptation activities; gender analysis and other participatory methods are empowering tools that can help communities identify their own capacities, as well as suitable adaptation strategies that respond to the needs of men, women, boys and girls	Make women's as well as men's concerns and experiences an integral dimension of the design, implementation, and evaluation of adaptation policies, programmes and interventions, so that women and men benefit equally and inequities are not perpetuated; adaptation strategies will only be sustainable if men and women are able to provide for their everyday needs.	Women's focus-group discussions Women-only focus-group discussions in Vanuatu raised concerns about the fact that the bulk of decision-making in relation to resource allocation following disasters was carried out by men; there was also concern that decisions made by men at the household and community level were not always fair, and most commonly did not involve women	Assessments should provide greater understanding of gender roles, in order to facilitate better understanding of how inequalities between men and women contribute to gendered vulnerabilities and ultimately impact upon a community's ability to become more resilient to the impacts of climate change
	Late 2000s	Ecosystem-based Adaptation	EBA	UNEP (2010) Pérez et al. (2010) Chandra and Dalton (2010)	EBA values and uses ecological services and biodiversity in ways that ensure that they continue to provide important services and help coastal and other communities adapt to the impacts of	Ecosystem-based management and restoration of ecosystems offer a valuable, yet often not fully recognised and therefore under-utilised approach for climate change adaptation which can replace or comple-	In Fiji EBA has been applied in marine and coastal initiatives utilising conservation mechanisms such as marine protected areas, mangrove rehabilitation, with a small number of programmes	However, EBA has not been popular in Fiji, largely due to a lack of understanding on the practicality of the approach and shared vision amongst stakeholders on the recognition and value of ecosystem services; successful

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					climate change	ment other adaptation actions such as building expensive 'hard' infrastructure (e.g. sea-walls and dykes)	focusing on watershed protection and water purification	implementation depends on improved understanding and stakeholder acceptance; a framework to integrate multi-level scientific knowledge about ecosystems and the services they provide matched to stakeholder preferences is needed
Method	Late 1980s	National Scoping Assessments	NSA	Pernatta and Hughes (1990) Hay (1993a;1993b) Hay and Kaluwin (1993)	Field and desk-top based scoping exercises to assess the potential impact of expected climate change on the national environment and socio-economic structure and activities; the studies were designed to lay the foundation for more comprehensive assessments at a later date	Initial regional studies undertaken by the UNEP/SPREP/ASPEI Task Team on Implications of Climate Change for the South Pacific undertook its assessments assuming that low latitude temperatures would rise by 2 C by 2100 and sea level would rise 1 m by around 2050; the latter value was considered conserv-ative, given that at the time estimates ranged as high as 4.5 m by 2100; studies were undertaken in ten countries; this was one of the	As well as the early regional assessments, more detailed national studies were undertaken in Kiribati, Tuvalu, Cook Islands, Marshall Islands, Tonga, (Western) Samoa, Tokelau, Federated States of Micronesia, Palau and Guam	None of the studies used the IPCC's Common Methodology for Vulnerability Assessment; some of the later published reports do not even specify the changes in climate and sea level that were assumed in the preliminary studies; those that did tended to favour the projections provided by the IPCC (1991)

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						earliest times that the results of IPCC assessments and scenarios were incorporated explicitly in vulnerability studies in the South Pacific		
	Early 1990s	IPCC Common Methodology	CM	IPCC (1991)	The Common Methodology is a guideline for assessing vulnerability to accelerated sea-level rise; it was the intention of IPCC that the documentation on the CM serve as guidelines for a generic tool, thereby providing sufficient detail for those initiating an assessment	Three levels of boundary conditions and scenarios were incorporated in the methodology: i) impacts on socio-economic development; ii) impacts on the natural coastal systems; and iii) the implications of possible response strategies for adaptation	The CM was used in separate vulnerability assessments for: Tongatapu, Tonga; Kiribati; Majuro Atoll, Marshall Islands; and Moorea, French Polynesia	The relatively detailed CM guidance was seen as a positive attribute; however, the expectation that assessments could be completed relatively quickly was not met; difficulties were experienced with its biophysical framework, the cost-benefit orientation of analyses of response options as well as differences from country to country in the importance given to climate change at the political and other levels
	Mid1990s	Stress Response Methodology	SRM	Kay and Hay (1993)	In response to the difficulties experienced in applying the CM to PICs, members of the SPREP/Japan Integrated Coastal Zone Management Programme built on	The SRM was based on an "optimal response" to climate change by PICs being one that would enhance the resilience and decrease the vulnerability of both	The methodology was applied to case study areas in Fiji, (Western) Samoa and Tuvalu	Shortcomings identified when the methodology was used in vulnerability and resilience assessments in Fiji, Samoa and Tuvalu included the subjectivity in

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					and expanded the CM into a broader assessment and decision-making support framework appropriate to the South Pacific and even more widely applicable	environmental and socio-economic systems		assigning vulnerability and resilience scores to individual coastal system components, and the difficulty of quantifying intrinsic values and valuing elements of subsist-ence societies
	Mid 1990s	IPCC Guidelines	G-V&A	Carter et al. (1994)	Experience gained during the First Assessment conducted by IPCC identified the need for a compatible set of methods in order to provide comparable regional and sectoral impact assessments	G-V&A is a study framework which allows comparable assessments to be made of impacts in different regions, geographical areas, economic sectors and countries; the general framework has seven steps starting with definition of the problem and ending with evaluation of adaptation strategies	The G-V&A have been widely used by PICs, including when preparing their First National Communications to the UNFCCC	A basic distinction was made between system responses to climate change that are automatic and built in (termed "autonomous adjustments") and responses that require deliberate policy decisions and implementation (“adaptation strategies); the distinction was due to the different treatment each receives in assessment studies
	Mid 2000s	Local Level Risk Management	LLRM	UNDP (2006) Gero et al. (2010) UNISDR (2010)	to incorporate community priorities in development planning and ensuring it becomes less sensitive to risks, including those related to weather and climate extremes	LLRM starts by addressing local development issues, and integrating risk management into existing development initiatives; this now includes management of climate-related risks	Fiji has used LLRM to reduce flood and other risks - this is done through work on local governance, and community planning and preparedness, as well as through individual	LLRM supports communities to manage and reduce disaster risk as well as foresee and control the emergence of new risks, such as those related to climate change; disaster risk reduction at the local

Category	From (in Pacific)	Name	Abbrev-iation	Key References	Intended Uses	Implementation	Findings and Examples	Strengths & Limitations
							participation and motivation; LLRM pilot projects have also been undertaken in other PICs, including Vanuatu and the Marshall Islands	level is more likely to be sustainable when projects start by addressing local development issues, and integrating risk management into existing development initiatives
	Late 1990s	Integrated Assessment Modelling	IAM	Warrick (2009) Warrick et al. (2005)	IAM is the use of simulation frameworks to capture the causes, mechanisms and impacts of a specific public policy issue, by integrating and simplifying the relevant processes and relationships included in theme-, sector- or scale-specific models	Over the past decade, important improvements to IAM have included use of an open architecture that facilitates the importing of user-specific information, the ability to provide more explicit consideration of demographic, land use and infrastructure patterns and changes and of adaptation options, incorporation of relatively simple economic tools, and the ability to run the models year-by-year rather than for a given time (e.g. 1990 or 2050); the latter provides the potential for superimposing the variability (including extremes) of climate (and/or sea level) on	In the Pacific, SimCLIM and its generic predecessor, VandaCLIM, have been used to link and integrate complex arrays of data and models in order to simulate, spatially and for current and possible future conditions, the bio-physical impacts and socio-economic consequences of climatic variations, including extreme climate and weather events	IAM makes it possible to: analyse the dynamic behaviour of complex systems; to better combine and communicate knowledge from a wide range of disciplines and perspectives; to produce internally consistent recommendations related to key issues and policy challenges facing society; to make explicit both uncertainties and gaps; however, PICs have had limited success with the use of IAM due to the substantial data requirements and the growing preference for bottom-up, community-based approaches and

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						the change in mean conditions over time, allowing improved quantification of impacts and assessment of adaptation options		methods rather than top-down, scenario-driven approaches and methods
	Mid 1990s	Comprehensive Hazard and Risk Management	CHARM	SOPAC (no date) Bettencourt et al. (2006) Sikivous et al. (2009) SOPAC (2009)	CHARM promotes close linkages between hazard risk management and other national development programmes; it also promotes hazard risk management as a comprehensive, all-of government process which aims to reduce the probability and the impacts of disasters and encourages risk transfer and avoidance	Natural hazard risk management strategies are developed for unavoidable risks; preparedness, response and recovery strategies are developed for risks where adaptation is impracticable; shifting the risk assessment process for hazards and disasters into a planning and development context requires enhanced capacity development, particularly in National Disaster Management Offices, and within the development sector as a whole	CHARM has been advocated / suggested to be the tool that assists in disaster risk reduction and disaster management planning in PICs, including Vanuatu, Republic of the Marshall Islands, Samoa, Nauru, Kiribati, the Cook Islands and Fiji; a key activity has been to assist PICs to review their disaster risk management arrangements and to strengthen relevant policies and institutions;	CHARM could be strengthened by incorporating robust economic risk assessments; the top-down approach to building capacity related to CHARM may have reduced its effectiveness; however, more recently, Papua New Guinea has addressed this issue by integrating CHARM with community-based vulnerability assess-ment approaches
	Mid 2000s	Technology Needs Assessment	TNA	UNDP (2010)	TNA for adaptation is a set of country-driven activities that identify and	TNA involves stake-holders in a consultative process; the activities may	Most PICs have assessed their technology needs for meeting the	Adaptation issues are inherently cross-sectoral and are often interrelated with

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					determine the adaptation technology priorities, identify the barriers to technology transfer and measures to address these barriers through sectoral analyses	identify soft and hard technologies, identify regulatory options and develop fiscal and financial incentives and capacity building	climate change challenge; they have followed a systematic approach that is used to identify, evaluate, and prioritise technological means for achieving sustainable development, increasing resilience to climate change and avoiding dangerous anthropogenic climate change; for example, the Cook Islands conducted a TNA for adaptation in 2009	mitigation options - in order to be truly effective, the TNA process should take these attributes into account; vulnerability assessments already carried out, or being carried out, can play a key role in identifying, and prioritising, adaptation technology needs; traditional indigenous technologies that have been used historically may have significant value in adaptation strategies and should be considered in the TNA process
	Mid 2000s	National Capacity Self Assessment	NCSA	GEF Global Support Programme (2005)	NCSA a country-driven consultative process of analysis and planning that determines national priorities and needs for capacity dev-elopment to protect the global environment	NCSAs identify country level priorities and needs for capacity to address global environmental issues, and biodiversity, climate change and land degradation in particular; they also provide an opportun-ity to identify critical capacity constraints, including the broader implications for	NCSAs have been undertaken by PICs, with funding provided by the UNFCCC through the GEF	Given that vulner-ability is strongly influenced by adaptive capacity, these assessment are highly relevant; the last step, to prepare a capacity development plan has proven problematic, as there is no guaran-teed progression to interventions that address the identified capacity constraints

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						national governance		
	Early 2000s	Community Vulnerability and Adaptation Assessment and Action Methodology	CV&A	Nakalevu (2006a; 2006b)	CV&A is a system-atic approach to assessing a com-munities' vulnerab-ility and adaptive capacity to climate change; the Methodology begins by documenting the current exposure and current capacity of the community to cope with climate change; the ultimate objective is to identify opportune-ities to strengthen the adaptive cap-acity of communit-ies to climate change	The Methodology built on various participatory approaches that had already been used in the Pacific, including CHARM, rapid rural appraisal, and participatory learning and action; the engagement of local stakeholders is encouraged at each stage of the assessment process	As part of the CBDAMPIC project, CV&A was used in four pilot project countries, namely the Cook Islands, Fiji, Samoa and Vanuatu	This approach was actively promoted as most PICs lacked the climate modelling and scenario generating capacity necessary for detailed climate change impacts studies; CV&A is a bottom-up method that requires consultations with communities in almost all aspects of the project; these consultations take time, preparation, resource mobilisation
	Mid 2000s	Integrated Assessment and Action Methodology	IAAM	Limalevu (2010)	IAAM is V&A assessment method that uses an approach to adaptation planning and implementation that integrates both climatic and non-climatic factors; IAAM assesses both vulnerability and possible adaptation options	The methodology evolved from the CV&A methodology developed under the CBDAMPIC project.; it also draws on other guides and tools such as the WWF Climate Witness Toolkit, the Local Management of Marine Areas Methodology, the UNDP Adaptation Policy Framework and the CHARM	IAAM has been used at six sites in Fiji; the recently commenced Pacific Adaptation to Climate Change (PACC) Project has adopted an action framework that fuses national mainstreaming and community-based approaches, using IAAM	IAAM uses both community-based approaches using participatory tools and facilitator-based approaches using rigorous scientific tools and methods; critically, the assessment and the plans are based on a firm understanding of the socio-economic, cultural and environmental

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						methodology; significant problems related to climate extremes presently faced by the community are addressed first, since building resilience to these, through disaster risk reduction, also increases resilience to longer-term climate change		problems currently faced by the community; they integrate climatic considerations into a broader framework of sustainable development, as perceived by the community
	Early 2000s	Cost-benefit Analysis	C-bA	Chadburn et al. (2010) Lal et al. (2009) Lal (2010) McKenzie et al. (2005)	C-bA is increasingly being used to inform and evaluate a range of interven-tions that can address climate and disaster risk; C-bA can be used as a decision support tool, to help decide between a range of possible intervent-ions that reduce risk and to maximise benefit for every dollar invested; C-bA can also be used to make an economic argument for investment in risk reduction, rather than responding to the	CBA is often perceived as a tool that is resource intensive, and that requires specialised technical skills; however, the principles of C-bA are applied to every day; where C-bA is used as part of a participatory process with communities, it can be extremely valuable, by helping communities and programme staff to think through the costs and benefits of different programme options, and targeting resources towards achieving “outcomes”,	The economic costs of the 2009 floods on sugarcane farmers in Fiji have been assessed, along with policy options for minimis-ing flood related disaster risk in the Fijian sugar belt; For the Pacific, CBA interventions related to flooding in Samoa and Fiji have also been analysed; data for Fiji, Niue, Tuvalu and Vanuatu have been used to assess the econom-ic impact of a selection of natural hazards on	C-bA is useful for both evaluation purposes as well as making forward looking planning decisions; C-bA introduces another layer of evaluation, encouraging a more robust analysis of benefits, as well as fostering a greater focus on outcomes as opposed to outputs; fundamentally, C-bA is about risk assessment, and hence uncertainty is inherent in the process, especially at a community level and in the face of climate change; data limitations can pose a

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					impacts of a future disaster event	rather than “outputs”	particular sectors, and the impact and cost-effectiveness of a range of disaster risk man-agement measures	substantial challenge, especially where there is not the capacity/ resource to conduct primary data collection; even where data can be collected, there are often significant levels of uncertainty over the data gathered
	Mid 2000s	Vulnerability Reduction Assessment	VRA	Droesch (2008) Petrini (2010b)	VRA a participatory impact assessment tool of common-unit indicators that can be used to determine community perceptions of climate risk and adaptive capacity before, during and after project implementation	VRA can be used to determine if a project is successful or unsuccessful in reducing climate change risks; the VRA comprises four indicators based on the UNDP Adaptation Policy Framework.	VRA has been used to assess the success of CBA initiatives in 11 villages in Samoa; six of 11 villages increased their VRA scores in one year, indicating an increase in their adaptive capacity	VRA has four fixed indicator questions; however, the means of assessing them is guided by local contexts, taking into account community considerations; community-level perceptions of climate change are confound-ed by factors that are attributable to non-climate factors
	Mid 2000s	Vulnerability and Capacity Assessment	VCA	IFRCS (2006) IFRCS (2007)	VCA is a particip-atory investigation method designed to assess the risks that people face in their locality, their different levels of vulnerability to those risks, and the capacities they possess to cope with a hazard and to	VCA is a method of working with people in rural and urban communities that is similar to the participatory approaches used for many years by several NGOs in their development work; VCA is used to assess vulnerability	12 PICs have now used VCA	VCA was applied at country level when it was first used as a sort of national-scale evaluation Process; as a result, the “capacity” part of VCA became confused with institutional strengthening or organizational

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					recover from it	and capacity and undertake action planning and implementation to reduce risk from natural hazards		development at national level; VCA is not suited to national assessments of vulnerability and capacity; the definition of vulnerability used in VCAs was at times vague and did not relate to natural hazards; as a result, pre-defined groups were sometimes identified as being vulnerable and requiring some form of welfare provision

Annex 4

Gaps in Information and Understanding Identified During the Review

This annex considers key gaps in information and understanding related to the approaches, methods and tools as well as to wider methodological issues relevant to the Pacific. The key gaps are:

- Shortfalls in information[3] – most notably the need for:
  - enhanced land elevation contour information (despite inherent limitations in vertical accuracy) in order to increase certainty in the risk assessment outcomes and move beyond strategic adaptation options to site-specific identification and implementation;
  - up-to-date maps showing land uses and infrastructure, including power and water lines;
  - end-user-relevant risk-based climate information (both present day and projected) such as found in climate risk profiles (e.g. ADB, 2010; McSweeney et al., 2009);
  - throughout the Pacific there is a scarcity of relevant applied natural and especially social science research and assessment to inform ocean and coastal policy and management (Caldwell et al., 2009);
  - a clearing house mechanism for information and data collection based on clearly identified needs and with functioning links to national websites; the Convention on Biodiversity has a clearing house mechanism that might serve as a useful model;
  - clarity on the roles and responsibilities of relevant regional organizations and improved understanding of the relative effectiveness of regional organizations and national institutions;
- How to ensure local concerns and priorities are acknowledged when increasing adaptive capacity;
- How to move from anecdote to evidence, by working with local communities, NGOs and governments to research, document and publicise the social, cultural and economic consequences of climate change;
- How to ensure additionality when integrating “climate” activities into existing work programmes; it is inappropriate to re-label existing development interventions as “climate adaptation”;
- How to best establish a link between the national efforts on climate change adaptation and disaster risk reduction and community-based approach of site-specific adaptation planning;
- How to make sustainable medium- to long-term adaptation and development decisions today, under conditions of imperfect information, including uncertainties;
- How to assess and transform institutions and governance arrangements common to both disaster risk reduction and climate change adaptation in order to achieve greater harmonization, coordination and cooperation;
- Identification of how adaptation strategies can best be integrated into coastal and marine policy, planning, and management frameworks and adaptation

[3] While the identified information is often critical to the success of assessments, it is most useful when combined with capacity building/ training programs to ensure that the results of the assessments can be used in decision making.

interventions identified and implemented for fisheries, aquaculture, and other marine-based industries;

- Identification of lessons learned from mal-adaptation and methods and tools that might help avoid mal-adaptation in the future;
- Absence of approaches to assess the effectiveness of insurance as an adaptation option from local (community, enterprise) to national scale, and other mechanisms for offsetting unavoidable losses;
- How to best assess the need for, and comparative benefits of, relocation (e.g. towns, villages, people) as well as the subsequent management of displaced people; in the longer term, strategic shifts in national policies and plans will be needed to manage increasing climate vulnerability and risks;
- The extent to which, and how, climate change is delaying achievement of PIC Millennium Development Goals;
- How to improve coordination and address any lack of cooperation between the increasing number of stakeholders involved in V&A assessments and interventions; and
- How to monitor and evaluate adaptation, in addition to what is provided in National Communications and normal project reporting; examples include retrospective cost benefit assessments of adaptation interventions and evaluation of the efficacy of the PIFACC.