GTZ Appraisal Mission

COPING WITH CLIMATE CHANGE IN THE PACIFIC ISLAND REGION (CCCPIR)

Sector Report: Adaptation to Climate Change related to Marine- and Land-based Natural Resources

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FINAL Report

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List of Abbreviations

ADB	Asian Development Bank
AusAID	Australian Agency for International Development
CCZM	Conservation and Coastal Zone Management
CROP	Council of Regional Organisations in the Pacific
DPCC	Development Partners for Climate Change
EDF	European Development Fund
EEZ	Exclusive Economic Zone
FAD	Fish Aggregating Devices
FFA	Forum Fisheries Agency
FSM	Federated States of Micronesia
GCCA	Global Climate Change Alliance
GEF	Global Environment Facility
GTZ	Gesellschaft für Technische Zusammenarbeit GmbH
IPCC	Intergovernmental Panel on Climate Change
JCS	Joint Country Strategy
JICA	Japan International Cooperation Agency
LDC	Least Developed Country
LMBNR	Land and marine based natural resources
LRD	Land Resources Division
LTE	Long Term Expert
MPA	Marine Protected Areas
MMA	Marine Managed Area
mt	Metric tonne
NAPA	National Adaptation Programme of Action
NGO	Non-Governmental Organisation
NZAID	New Zealand Agency for International Development
OECD DAC	Organisation for Economic Cooperation and Development – Development Assistance Committee
PACC	Pacific Adaptation to Climate Change
PASAP	Pacific Adaptation Strategy Assistance Programme
PIC	Pacific Island Countries
PICT	Pacific Island Countries and Territories
PIFACC	Pacific Islands Framework for Action on Climate Change
PPCR	Pilot Programme on Climate Resilience
RMI	Republic of the Marshall Islands
SciCOFish	Scientific support for the management of coastal and oceanic fisheries in the Pacific Islands region
SIS	Small Islands States
SPC	Secretariat of the Pacific Community
SOPAC	South Pacific Applied Geoscience Commission
SPREP	South Pacific Regional Environmental Programme
STE	Short Term Expert
TA	Technical Assistance
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change

1 Executive Summary

Coastal communities in the Pacific are without doubt some of the most vulnerable to climate change effects in the world. The limited land area in some countries and low profile of atolls (many only 3m above sea level at high tide) exacerbate the vulnerability of these locations, and the governments and people of these countries have limited capacities and resources to cope at all levels.

Land and marine based natural resources play an important role for sustainable development in the region, but are already impacted by climate change and they are largely unprepared for future changes. The combination of low adaptation capacity in sustainable management of LMBNR in view of existing climate extremes and future changes (core problem) and intensive climate impacts is threatening the region's sustainable development. This lead to increasing negative impacts of natural disasters, food and water shortages, economic losses, poor livelihoods, and further degradation of natural resources.

This report proposes to provide capacity building for climate change adaptation, with a focus on sustainable management of land and marine based natural resources, in a multilevel approach (regional, national and subnational/ community level). At the regional level, coordination on and mobilisation of climate change adaptation initiatives would be improved, and capacities of technical CROP agencies to support and advise member states to plan for and implement adaptation will be strengthened. Exchange between stakeholders in adaptation in the region will be supported. CROP agencies are thus strengthened in their mandate to supplement national capacities, given that there are limits to building up full climate change advisory services, and specialised expertise in the small member states of the Pacific.

At the national level, countries will be supported to complete their frameworks to address climate change in a strategic and coordinated manner and to fully integrate adaptation concerns into sector operations and development planning. Capacities to identify and implement adaptation options, set up the necessary institutional arrangements and apply adaptation techniques within the sectors and operations will be strengthened throughout governments, as will learning and sharing of experiences. Implementation will to a large part take place at the community level. In the Pacific, community-based approaches have been considered a particularly useful approach in multi-island countries, where communities may be relatively removed from national government initiatives. Active participation of the community, especially of women and the most vulnerable, at all levels of the project will be encouraged.
With this, economies of scale should be maximized regarding resources and coordination potential. At the regional level high quality advice will be generated, capacities extended within CROPs and communication between CROPs strengthened. Capacities at the national and subnational level will be increased, and effective and participatory approaches implemented at national and community levels, with exchange across levels and within the region encouraged through CROP agencies and the specific networking and knowledge management activities of the project.

2 Context/Problem Analysis (with implications for target groups)

2.1 Background on the Pacific

There are 22 Pacific island countries and territories (PICTs) in the Pacific region, excluding Hawaii and the United States possessions (Figure 1). The 22 PICTs have an area of exclusive economic zones (EEZs) totalling 29.3 million km^2, while the total land area is just over 550,000 km^2, giving a ratio of ocean to land of 53:1. The mid-year 2008 population figure for the region was around 9.5 million people (Table 1). Of the 22 PICTs, one country, Papua New Guinea, accounts for 83% of the land area and 63% of the total population.

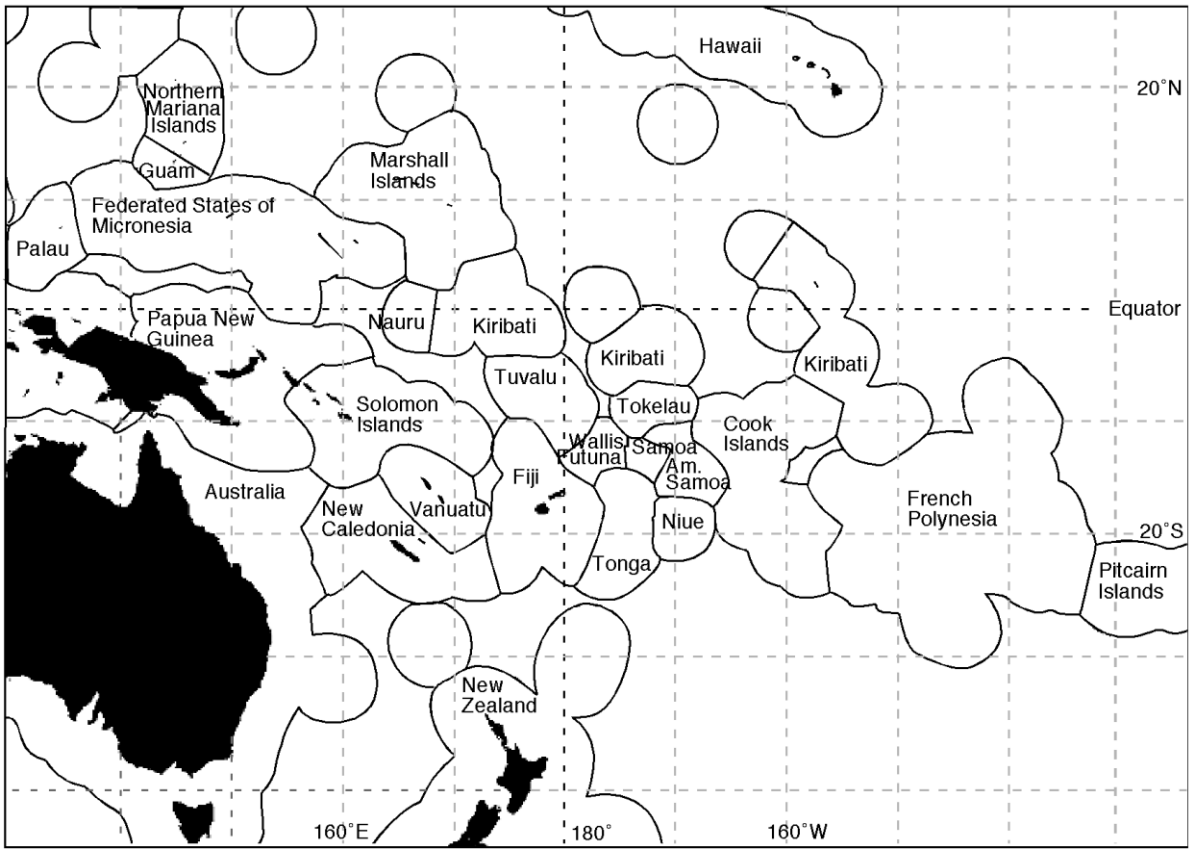

Figure 1: The Pacific Region showing the 22 PICTs and their EEZs (source, SPC Noumea).

The current GTZ mission is focused on the 12 independent member states of the Secretariat of the Pacific Community (SPC), namely the Federated States of Micronesia, Fiji Islands, Kiribati, the Republic of the Marshall Islands (RMI), Nauru, Palau, Papua New Guinea, Samoa, Solomon Islands, Kingdom of Tonga, Tuvalu and Vanuatu. These countries have a mix of high islands and atolls.

Table 1: Population, land area and EEZ area for the 22 Pacific Island countries and territories.

Country/territory	Population (2008 mid-year estimate)	Approximate land area (km^2)	Approximate ocean or EEZ area (km^2)
American Samoa	66,107	199	390,000
Cook Islands	15,537	237	1,830,000
*Federated States of Micronesia	110,443	701	2,780,000
*Republic of the Fiji Islands	839,324	18,272	1,290,000
French Polynesia	263,267	3,521	5,030,000
Guam	178,980	541	218,000
*Republic of Kiribati	97,231	811	3,550,000
*Republic of the Marshall Islands	53,236	181	2,131,000
*Republic of Nauru	10,163	21	320,000
New Caledonia	246,614	18,576	1,740,000
Niue	1,549	259	390,000
Commonwealth of the Northern Mariana Islands	62,969	457	777,000
*Republic of Palau	20,279	444	629,000
*Papua New Guinea	6,473,910	462,840	3,120,000
Pitcairn Islands	66	39	800,000
*Samoa	179,645	2,935	120,000
*Solomon Islands	517,455	28,370	1,340,000
Tokelau	1,170	12	290,000
*Kingdom of Tonga	102,724	650	700,000
*Republic of Tuvalu	9,729	26	900,000
*Republic of Vanuatu	233,026	12,190	680,000
Wallis and Futuna	15,472	142	300,000
TOTAL	**9,498,896**	**551,424**	**29,325,000**

* Countries being covered by the GTZ project.

Given the huge ocean area and limited land, Pacific Islanders rely heavily on marine resources for both subsistence and livelihoods. When looking at fisheries, there are two distinct sectors; industrial offshore fisheries for tuna, and coastal or reef fisheries, including freshwater and aquaculture.

The industrial tuna fishery of the western and central Pacific Ocean (WCPO) is largely based on distant water fishing nations coming to the Pacific and paying access fees to PICTs to fish for tuna in their EEZs. This trend is changing slowly with some PICTs becoming involved in the tuna fishery through joint venture fishing operations and development of domestic fishing fleets. In 2008 the total catch from the WCPO was 2.4 million mt, which represents around 56% of the global tuna catch (OFP 2009).

The total regional fishery and aquaculture production in 2007 within the EEZs of the 22 PICTs was 1,330,345 mt plus 305,336 pieces (from aquaculture production). The majority of this catch (1,148,781 mt valued at USD $1,513,418,176) was tuna as part of the industrial tuna fishery. The balance of 181,564 mt (valued at USD $536,045,411) is made up of subsistence, small-scale coastal commercial, freshwater and aquaculture production (Gillett 2009), which is what the people of the PICTs rely on for food security and livelihoods.

Food security is a major concern for many of the PICTs, especially the Small Island States (SIS) where land area is limited. Increased pressure is expected on land and marine based natural resources as a result of increasing population in the Pacific region, and this is estimated to increase by around 50% by the year 2030 (SPC 2008). In actual terms, the

estimate is that an additional 115,000 mt of fish will be needed in 2030 to maintain traditional patterns of consumption. Given that many coastal or reef resources are fully exploited, or over exploited in the case of commercial invertebrate species, food security is at risk with the estimated population growth and the need to increase fish production. Any effects of climate change will only add to the vulnerability of PICTs to maintain sustainable subsistence production.

2.2 Vulnerabilities to and impacts of climate change

Coastal communities in the Pacific are without doubt some of the most vulnerable to climate change effects in the world. The limited land area in some countries (refer to Table 1) and low profile of atolls (many only 3m above sea level at high tide) exacerbate the vulnerability of these locations, and the governments and people of these countries have limited capacities and resources to cope at all levels.

Given the economic, demographic and geographic conditions, Pacific Islands face a number of general vulnerabilities:

- high growth rates and densities
- poorly developed infrastructure
- limited natural, human and economic resources
- high dependence on marine resources
- high sensitivity to changes in water supply and demand
- economies vulnerable to external forces (changing terms of trade, trade liberalisation, migration flows)
- coral reef and mangrove ecosystems whose health and productivity of have considerable impact on people's well-being and livelihoods

The 4th IPCC report identifies, with a high degree of confidence, the following four risks posed specifically to island states, which also summarises key vulnerabilities also for the Pacific Islands:

- Sea level rise is expected to exacerbate inundation, storm surge, erosion and other coastal hazards, thus threatening vital infrastructure, settlements and facilities that support the livelihood of island communities.
- Deterioration in coastal conditions, e.g. through erosion of beaches and coral bleaching, is expected to affect local resources.
- By mid-century, climate change is expected to reduce water resources in many small islands, e.g. in the Pacific, to the point where they become insufficient to meet demand during low-rainfall periods.
- With higher temperatures, increased invasion by non-native species is expected to occur, particularly on mid- and high-latitude islands.

An indication of key vulnerabilities and priorities in different sectors across the region is given by the countries that have prepared National Adaptation Programmes of Action (NAPAs). These indicate priorities for adaptation in regards to agriculture, water resources, coastal environments, food security, infrastructure and settlements, and health (see Annex 1 for details).

The examples below of impacts of climate change illustrate the severity these can have:

- In 2003, Fiji experienced severe flooding and losses from Cyclone Ami in key development sectors, namely housing, education, health, agriculture, tourism, sugar, business, infrastructure, telecommunications and power supply. The cost of damage was estimated at FJ$104.4 million with over 70% of this damage to the public sector. The cyclone also caused fourteen deaths.
- By 2050, and under a suite of climate change scenarios, Tarawa in Kiribati could experience annual damages of about US$8─$16 million. This estimate takes into account only the potential impacts of climate change on coastal areas (US$7.$13 million a year) and water resources (US$1.$3 million a year).
- In RMI, it was estimated that a one-meter rise in sea level could easily wipe out more than half of the island of Majuro.
- In Tonga, the squash crop which had been producing 50% of the country's exports by value was more than halved.
- In Vanuatu, the most comprehensive impact assessment was conducted for Cylcone Ivy in 2004; the assessment estimated a total cost at VT427.6 million, affected 50,000 people, 90% of water resources, 70% of roads, 60% of health infrastructure, 112 schools and over 80% of food crops were damaged.

The two most encompassing recent studies on the economics of climate change both have one Pacific Island – Samoa – as a case study. These studies will provide further insights and understanding of impacts of climate change and efficient response options. The World Bank is currently analysing the economics of adaptation for Samoa as part of a global study with 7 country cases. The already published study, "Shaping climate-resilient development - A framework for decision-making", prepared under the lead of McKinsey stressed the high vulnerability of small island states (see Box 1).

Box 1: McKinsey Study: Shaping Climate Resilient Development - Test case on Samoa

The Samoa test case confirmed the hypothesis that Small Island Developing States are particularly exposed to high risk. In 1990, the country was hit by Cyclone Ofa, which destroyed buildings, infrastructure, and crops through wind and flooding damage. Due to sea level rise, the frequency of events with Cyclone Ofa-like intensity will likely increase from once every 50 years to once every 20 years in 2030 in the high climate change scenario. As a result, annual expected loss might increase from 5 to 8 percent of GDP in Samoa. Note that, due to its volcanic nature, Samoa has plenty of high ground to which the population can move – although at significant cost. Conversely, the effects of sea level rise will be much more severe on atolls or other low-lying islands, where the population cannot simply relocate to a higher elevation.

Some 70 percent of Samoa's villages lie along the coast, and one in three buildings is located below a 4 meter elevation, making the country and its people highly vulnerable to flooding from tropical cyclones. Sea level rise resulting from climate change, the focus of this case, could magnify this risk. It could also cause salt water to encroach into the fresh groundwater aquifer, compromising fresh water sources and threatening both human health and coastal agriculture. Even in a scenario of high climate change, however, the bulk of losses can be averted: cost-effective flood-aversion measures, for example, include planting a protective mangrove buffer, using mobile flood barriers, and requiring a minimum elevation for new buildings. The approach used to assess risks and identify such measures could be replicated in many other island settings.

Source: Shaping climate-resilient development. A framework for decision-making. (2009). Prepared by: Economics of Climate Adaptation Working Group, a partnership between the Global Environment Facility, McKinsey & Company, Swiss Re, the Rockefeller Foundation, ClimateWorks Foundation, the European Commission, and Standard Chartered Bank.

2.3 Institutional frameworks, knowledge base and capacities to address climate change in the Pacific Islands Countries

Knowledge base and analytical capacities

Meaningful adaptation to climate change requires an understanding of changes in climate stimuli (such as precipitation, sea level, winds and storms, besides temperature) and of impacts of climate change on sectors and regions. Climate information in the Pacific is incomplete and scattered, and awareness of available information products and the capacity to use it is partly low amongst institutions and actors dealing with the impacted sectors.

While to date downscaled information on climate stimuli is still poor, an Australian funded Climate Change Science Programme for the Pacific has recently started and will provide climate projections derived from regional climate models, and newly digitised data. This project intends to use this information as soon as it is available. Several of the PICs are already using SimCLIM[1] for climate change modeling (Papua New Guinea soon, Solomon Islands, Vanuatu, Tonga, Australia, New Zealand, etc.).

With regards to vulnerabilities, constituted by exposure of settlements/infrastructure, sectors/livelihoods or communities to climate change, data from disaster risk reduction is available, but too coarse in many areas for precise analysis and as a basis for decision making. Data products derived from satellite imagery and aerial photography, detailed topographic maps in particular, could be produced with reasonable effort for densely populated atolls, given the small size of the countries, but this work is only starting.

Impacts of climate change on sectors and land- and marine-based natural resources are poorly understood. The Secretariat of the Pacific Community (SPC), funded through AusAID is currently scoping the variables for a monitoring system for climate change effects in marine ecosystems. SPC's Land Resources Division (LRD), with support from the ongoing GTZ project, is currently developing a regional database on climate-related information for land-based natural resources. Such information bases will be a major input to planning for climate change adaptation.

Policies and strategies for adaptation to climate change and integrating adaptation into development

The concept of mainstreaming and need for good policy frameworks are widely acknowledged in the region, as reflected by the following:

- The Pacific Islands Framework for Action on Climate Change (PIFACC) strongly calls for mainstreaming climate change adaptation: It states: Appropriate adaptation measures integrated into national/sectoral sustainable development strategies or their equivalent and linked to the budgeting process (Outcome 1.4) and Climate change considerations mainstreamed into national policies, planning processes, plans and decision-making at all levels and across all sectors (Objective 2.1).
- National climate change policies (e.g. Kiribati's National Framework for Climate Change and Climate Change Adaptation; completed in April 2010). Several countries

[1] A commercial intergrated modelling system for assessing climate change impacts and adaptation.

have made clear policy statements at the highest government level that can now be mainstreamed into sectoral policy, and then down to state, provincial, community policies; or operationalised in national adaptation strategies.

Table 2 provides an overview of the existing policy frameworks in the 12 PICs addressed by this appraisal mission.

Points of departure in many countries are National Adaptation Programmes of Action (NAPAs), which are being produced by Least Developed Countries (LDCs) under the United Nations Framework Convention on Climate Change (UNFCCC), and National Communications, the national reports of all countries that are signatories to the UNFCCC. While NAPAs identify urgent and immediate adaptation needs of LDCs, which can receive funding through the UNFCCC's Least Developed Countries Fund and any other bi- and multilateral support, the National Communications describe vulnerabilities to and impacts of climate change and report on action taken by countries to address them, without usually being meant as national strategies. As many countries in the Pacific are currently working on their second National Communications, the country teams set up to elaborate them are commonly useful structures for developing adaptation strategies, where appropriate. However, encompassing climate change adaptation strategies are lacking in most countries.

Several countries have moved the responsibility for climate change adaptation to the Office of the President, showing the high profile of this issue for many PICs. Given their high vulnerability, countries can expect significant amounts of climate finance from the international donor community and targeted climate finance, which reemphasises the need for sound adaptation strategies and mainstreamed approaches.

Table 2: Existing climate policy frameworks in the 12 PICs

Country	Reference to Climate Change in Development Plans / Strategies	Adaptation Strategy (thematic scope and time frame)
Fiji	Strategic Development Plan (2007-2011) (acknowledges that climate change is a major challenge in small island states like Fiji)	National Climate Policy (2009) Capacity building, cross-sectoral Adaptation strategy for land resources under development
Vanuatu		NAPA (2007), Short term, cross-sectoral Adaptation strategy for land resources under development
Solomon Islands	Medium-term Development Strategy 2008–2010. Climate change covered under Priority Area E(e).	NAPA (2008) Short term, cross-sectoral
Papua New Guinea	Medium-term Development Strategy (2005-2010)	
Tonga	Tongan Strategic Development Plan eight (2006/07–2008/09), with climate change covered.	Adaptation strategy for land resources under development (ACCPIR)
Samoa	Strategy for the Development of Samoa 2008–2012. Climate change covered under Priority Area 3, Goal 7. Climate change acknowledged as threat to forest and biodiversity, and to cause increased vulnerability to natural disasters	NAPA (2005) Short-tern, cross sectoral
Nauru	Nauru's National Sustainable Development Strategy 2005–2025. There is no mention of	

	climate change in the document; however, food security is a priority area of concern	
Kiribati	Kiribati Development Plan 2008–2011, Key policy area 4 covers environment and climate change	NAPA (2007) short term (3-year-plan), cross-sectoral New strategic framework developed in 2010. Implementation of policy to be coordinated by the Office of the President through the Ministry of Environment, Lands and Agricultural Development
Tuvalu	Te Kakeega II 2005–2015 National Sustainable Development Plan. Climate change covered under Strategic Area 7. Need for reliable climate change proof infrastructure. Also acknowledges cc impact on fisheries, agric, sea level rise	NAPA (2007), Short term, cross-sectoral
Rep. Marshall Islands	RMI Strategic Development Plan Framework 2003–2018 (VISION 2018) A key component of the plan is environment sustainability to ensure development is sustainable	
FS Micronesia	FSM Strategic Development Plan 2004–2023 covers climate change through Goals 1 and 3. Recognises need to mainstream cc into national policies, planning and economic dev	
Palau	Brief mention of climate change in Palau's Medium Term Development Strategy – Action for Palau's Future 2009–2014, with this linked to the National Master Development Plan – Palau 2020. Identifies need for integration of CC management policies into the plans and strategies of the infrastructure sector	Palau Climate Change and Adaptation Road Map (ADB, 2009)

2.4 Specific vulnerabilities and adaptation options regarding land and marine based natural resources

Pacific people have a strong affiliation with the marine environment, which provides a large part of the daily protein intake of the population, so any effects of climate change on the marine environment will affect food security and livelihoods. Some countries, especially in Polynesia, have a history of fishing outside the reef for tuna and other pelagic species, while in Melanesia, most fishing activity is conducted on the reef flats or in the lagoon. The fisheries sector can be split into two distinct areas, oceanic and coastal fisheries. The oceanic fishery is the main focus area for governments, as this brings in revenue to government through access agreements and licensing arrangement for foreign fishing vessels to fish within the EEZs of the Pacific Island countries and territories.

Land, on the other hand, is a very scarce resource. The Pacific islands are not food self-sufficient and must import a large proportion of their food. As such, agriculture contributes only a small proportion to GDP: 10.4% in RMI (2001 figure) and 6.2% in Palau, for example. Yet, agriculture is still an important livelihood and profitable sector especially in larger countries. With their rapid population growth and limited natural resources, Pacific islands, especially the atolls, face significant challenges in terms of food security.

Land- and marine-based natural resources will be affected by sea level rise, which will reduce the land area available for habitation, and may affect the availability and quantity of underground fresh water (water lense). Salt water intrusions into agricultural land will limit the crops that can be produced. Increases in sea water temperature and acidification of the ocean will greatly affect the marine environment and biodiversity, both with coral and other habitats (sea grasses, mangrove forests) and the fish resources (reef finfish and invertebrates) within the marine environment. The regional tuna resource that many countries rely on for economic development and local consumption may also be affected with early predictions indicating that the main body of tuna will move more to the east under such conditions. This would have a negative impact on the countries in the western Pacific, and possibly positive effects on countries in the eastern Pacific.

The Pacific is also experiencing more severe and extreme weather conditions, with stronger or more intense cyclones and flood and drought conditions. More intense rainfall may attribute to higher siltation of lagoons depending on land management practices and related soil erosion. Less rainfall, especially in the dry season, will affect the people unless adequate water storage is available to ride out drought conditions.

In many locations, especially around main or large urban centres, over-harvesting of resources has occurred, especially commercial invertebrate species and favoured finfish species, so any increased stress on these resources as a result of climate change will have a devastating effect. Therefore, adaptation options related to land- and marine-based natural resources will have to address food security, conservation, livelihood and disaster management issues. There is a range of adaptation options that can be explored in the fisheries or marine sector, and these include:

- The use of marine protected areas (MPAs) or marine managed areas (MMAs) as a tool for managing resources or locations affected by climate change. When using this approach, there need to be clear objectives or reasons for implementing an MPA/MMA, and the selection of suitable sites is critical.
- Sustainable community-based management of coastal fisheries (finfish, invertebrates and habitat) is a key adaptation strategy. This will also require monitoring of the resources and habitat to measure success of the management in place, with management adapted and refined based on the results of monitoring.
- Use of nearshore fish aggregating devices (FADs) to assist displaced local fishers from areas where MPAs/MMAs have been implemented, or redirect fishing pressure from reef resources to the pelagic tuna resource.
- Sports fishing or other eco-tourism activities where communities or community members focus on non-extractive methods or use of marine resources.
- Small-pond aquaculture has potential in countries with adequate land area and good access to fresh water (high rainfall, close to rivers). Land tenure may be an issue in some countries.
- Cage culture of species in lagoons where there is adequate current flow. This will require juvenile fish being captured and put in the cages for rearing, of fingerlings being provided from a hatchery.

- Farming of different marine products (seaweed, corals, live rock, clams, trochus, aquarium fish, sea cucumbers, etc.) as alternative income generating activities focused on export markets. A hatchery may be needed for some of these species.
- Planting of mangroves to reduce erosion of coastal areas and provide a potential nursery area for some juvenile marine resources.
- Proper evaluation of plans for sea walls as these may affect current flows within the lagoon with flow-on effects in the marine environment. The same applies for any proposed coastal infrastructure project.

Key agricultural adaptation measures consist of both modern techniques as well as a return to traditional ones that had been well adapted to the specific conditions on the islands, but were replaced in the face of commercialisation of agriculture. Such traditional techniques include pulaka pits (a form of agroforestry system), and using coconut husks as a hydroponic medium for growing other crops. In addition to these traditional systems, there is also a need for new technologies that are sensitive to the agricultural conditions in the Pacific, and which can improve local food supply and create more market opportunities for farmers. Soil fertility can be increased by using leguminous cover crops (eg *Gliricidia sepium* and *Calliandra purpurea*) or using charcoal in combination with compost. Research on pest and disease control or new crop varieties that are drought- or saline resistant is another important measure. In Samoa, a participatory taro breeding programme has taken place and the Centre of Excellence for Atoll Agriculture was established in 2008. Improved water management techniques are also needed in the face of increasing water scarcity. Such techniques should be developed in parallel with resource management systems and integrated land use plans which also consider climate change and its impacts.

2.5 Key problem statement

Pacific islands are among the countries most vulnerable to climate change globally, with considerable differences in the level of vulnerability between and within countries. Coastal communities, atoll islands, and the densely populated and low-lying deltaic regions on larger islands are particularly vulnerable to even small changes in climatic variables, especially sea level rise and climate variability, including drought conditions and tropical storms. Vulnerability is constituted by high population densities and growth rates, scarce natural resources particular land and water, high exposure to natural hazards because of small and low-lying land mass and geographical location in cyclone and typhoon zones, poorly developed infrastructure, limited human and economic resources because of poverty and small size of countries, high external dependency of economies.

The high pressure on land and marine based natural resources already leads to unsustainable use of these resources, reduces the natural resistance of ecosystems, weakens the functions of ecosystems as natural shields against natural disasters and threatens livelihoods of communities depending on them. It has been reported by the IPCC that climate change has already worsened this situation, and natural resource management in most Pacific Islands is largely unprepared for future changes through climate change. Impacts of natural disasters have worsened. Due to often ineffective planning of both land and water resources the impacts from climate change like drought, flooding, and extreme weather events are exacerbated.

Adaptive capacities in terms of human resources to analyse risks, identify adaptation options and steer implementation as well as institutional arrangements to effectively plan and coordinate implementation are very limited in these small countries. The information base on climate change adaptation and vulnerabilities is insufficient and, where it exists, awareness of and skills to use information is lacking in relevant departments. Technical CROP agencies at the regional level partly supplement national capacities, and have started providing climate change advisory services to member countries in the area of climate change adaptation, but cannot yet offer sufficient support to countries (in terms of sufficient data, techniques and capacities).

Awareness about the risks climate change is posing to development is very high in the region as reflected in regional and national climate policies and statements and requests for support on climate change related problems by communities. However, the existing regional framework Pacific Islands Framework on Climate Change (PIFACC) is weakly monitored and lack of coordination prevents fully exploiting economies of scale and adding full value. At national level strategic and operational frameworks to guide and implement adaptation priorities are largely absent, while many countries have declared climate change adaptation and integration into national planning a priority. Line ministries and agencies in the impacted sectors, including those dealing with land and marine based natural resources (LMBNR), have not yet developed strategies to approach climate change nor integrated climate change into their operations. Community approaches are common in the region, but only reach a small part of communities to date.

The combination of low adaptation capacity in sustainable management of LMBNR in view of existing climate extremes and future changes (**core problem**) and intensive climate impacts is threatening the region's sustainable development. Land and marine based natural resources play an important role for sustainable development in the region, but are already impacted by climate change and they are largely unprepared for future changes. This leads to increasing negative impacts of natural disasters, food and water shortages, economic losses, poor livelihoods, and further degradation of natural resources.

3 Past and Current TA of Donors addressing the issue (by donors)

There has been a range of climate change projects undertaken in the Pacific in the land and marine based natural resource (LMBNR) area. Annex 2 covers some of the main projects currently underway in the Pacific. The main donors include Australia (with AusAID), Japan (with JICA), New Zealand (NZAID), European Union (EDF and GCCA), the Asian Development Bank (ADB), Taiwan, and the United Nations Development Programme (UNDP) including the implementation of Global Environment Facility funded projects. Annex 3 covers the donors and country representatives consulted during the course of this scoping mission.

4 Proposed Technical Assistance (areas, measures, instruments) and its rational (in line with country/sector concepts of BMZ)

4.1 Approach

It is proposed that adaptation to climate change with a focus on sustainable management of land and marine based natural resources be addressed as the focal area of the technical cooperation. This addresses key vulnerabilities and adaptation options to enhance and sustain sustainable development in view of climate change, and responds to regional and national priorities. It fills an important gap in the landscape of donor support.

Capacity building for climate change adaptation, with a focus on sustainable management of land and marine based natural resources, is addressed through three components (**component 1 to 3**), which constitute a multilevel approach (regional, national and subnational/ community level). The experiences from the local level feed back into national and regional level design of framework conditions and climate change advisory services. National level implementation experiences likewise inform regional coordination and advice. In addition, component 4 on tourism contributes learning experiences regarding private sector involvement and establishing business opportunities for communities.

At the regional level (**component 1**), coordination on and mobilisation of climate change adaptation initiatives will be improved, and capacities of technical CROP agencies to support and advise member states to plan for and implement adaptation will be strengthened. Exchange between stakeholders in adaptation in the region will be supported. CROP agencies are thus strengthened in their mandate to supplement national capacities, given that there are limits to building up full climate change advisory services, and specialised expertise in the small member states of the Pacific. At the national level, national coordination bodies for climate change, agencies associated with line ministries, and nongovernmental institutions are strengthened to put in place adaptation strategies, operationalise and integrate existing strategies into national and sector strategies, plans and policies, budgeting and standard procedures in the line ministries (**component 2**).
Areas for support at the national level will include agriculture, fisheries, forestry, food security, water resources management, conservation, and land use planning, depending on the needs of different countries. A close link with disaster risk reduction will be needed. Countries will be supported to complete their frameworks to address climate change in a strategic and coordinated manner and to fully integrate adaptation concerns into sector operations and development planning. Capacities to identify and implement adaptation options, set up the necessary institutional arrangements and apply adaptation techniques within the sectors and operations will be strengthened throughout governments, as will learning and sharing of experiences (**component 3**).

Implementation will to a large part take place at the community level (**component 3**). In the Pacific, community-based approaches have been considered a particularly useful approach in multi-island countries, where communities may be relatively removed from national government initiatives. In all countries communities are important constituencies with strong local authorities and traditional leaders. Community residents through this can be empowered to protect local resources in the face of climate change. Active participation of the community, especially of women and the most vulnerable, at all levels of the project will be

encouraged. Community knowledge and existing adaptation strategies are used as starting points and interventions are tailored to fit local conditions and cultural norms. Alongside efforts to address climate change at the national level community-based approaches to adaptation will be supported.

Adaptation activities will be assessed for their appropriateness, and where possible activities will be encouraged as part of community development planning, conservation, coastal zone management and disaster risk management, especially in atoll locations. Most fishers on atolls are also farmers (and vice versa); communities take a more holistic approach to their lives and in the activities they undertake for food security and livelihoods. Therefore, adaptation measures that follow such a holistic approach are more appropriate here instead of sectoral approaches. The focal areas would be LMBNR and CCZM, with these also linked to livelihoods.
In the fisheries sector, there may be scope for specific adaptation activities only covering this sector. There is specific potential for small-scale aquaculture projects where adequate land and fresh water is available. In some larger lagoons, cage culture of fish (and possibly some invertebrate species) may be carried out on a subsistence or commercial basis.

The three scalar components complement each other so as to economise on capacities, resources and coordination potential. At the regional level high quality advice will be generated, capacities extended within CROPs and communication between CROPs strengthened. Capacities at the national and subnational level will be increased, and effective and participatory approaches implemented at national and community levels, with exchange across levels and within the region encouraged through CROP agencies and the specific networking and knowledge management activities of the project.

4.2 Suggested components on adaptation to climate change regarding LMBNR

Topic	Component 1: Capacity Development on Climate Change in CROP agencies	Component 2: Developing adaptation strategies and mainstreaming regarding LMBNR	Component 3: Implementing adaptation measures (LMBNR), including at the community level
Objective (module objective)	The capacities in climate change management of CROP agencies which are part of the institutional partnership architecture are strengthened	Selected Pacific Islands have climate change adaptation strategies and mainstreaming processes in place to implement adaptation relating to LMBNR according to agreed priorities and as an integral part of development and sectoral planning	Pacific Island countries have successfully implemented and assessed adaptation measures in relation to LMBNR, including CCZM, building up experiences and contributing to their adaptation priorities
Target groups (with gender context)	• Vulnerable population in the Pacific • Private sector involved in LMBNR activities, coastal infrastructure development projects and disaster risk management • Coastal communities that are assessed to be vulnerable to CC effects, with a focus on women and women's groups		
Regional coverage	• PICT regional organisations	Potentially, all 12 participating countries will be included. During the consultations, 10 countries expressed specific demands in the areas of developing or operationalising national adaptation strategies regarding LMBNR or mainstreaming climate change adaptation. The focus of cooperation in the different countries has been identified as follows and detailed in Annexes 4 and 5. Some degree of flexibility according to changing needs in a highly dynamic policy field in these countries needs to be taken. - Adaptation strategies and databases for land based natural resources and integrating climate change concerns into respective policies: Fiji, Tonga, Vanuatu - Adaptation strategy and mainstreaming adaptation into policies for land and marine resources in atoll	Given the potential CC effects will have on the resource base (land and marine based) and related food security, and resilience of coastal communities and livelihoods, all 12 participating countries will be included with some activities in LMBNR, CCZM or a component of these. It is essential that for atoll locations, LMBNR and CCZM activities need to be combined and addressed through an integrated approach. Sectors of special priority as identified in the mission in these countries are as follows: Food security: FSM, Kiribati Marine resources: Nauru, Tuvalu, Samoa Land resources: Fiji, Tonga, Vanuatu, Papua New Guinea Water resources: RMI, Solomon Islands,

		countries with special emphasis on food security: FSM, Kiribati, Tuvalu - Integrating climate change concerns into water resources management: RMI - Integrating climate change adaptation into management of marine resources: Samoa, Nauru - Integrating climate change adaptation into development planning across levels: Solomon Islands	Palau
Partner institutions and other implementing agents/counterparts (regional, state members)	• The main CROP partners will be SPC, SPREP, and to a lesser extent USP • PIFS	• CROP partners • At country level, main partner institutions will be government departments responsible for climate change adaptation and line ministries in fisheries, agriculture, and management of natural resources	• CROP partners • National government departmens • National and regional NGOs would also be partners or counterparts and possibly some parts of projects can be implemented through them, especially at the community level. • Private sector
Actions/Measures	• Support to PIFS in upstreaming/coordination • Support to SPREP to monitor and coordinate PIFACC • Support to make the position of the Climate Coordinator in SPC operational, improved coordination and cooperation of CROP including through joint JCS • Trainings on adaptation skills within CROPs • Development of advisory tools on adaptation techniques regarding LMBNR • Adapting climate proofing procedures, economics of adaptation • Knowledge management on climate change adaptation for LMBNR • Supporting learning and exchange in	• Impact and vulnerability assessments for specific regions/management systems, • Costing studies, provision of methods for prioritizing options, • Policy advice (e.g. review of sector policies and plans) and support to stakeholder consultation processes • Capacity building regarding sectoral impacts of CC and adaptation techniques and options, • Training on tools for climate proofing, • Development of guidelines and procedures for climate proofing and mainstreaming climate change	• Capacity building tin national government and communities • Small grants scheme implemented in collaboration with other donors • Specific sectoral advice and support (land, marine and conservation) provided on adaptation activities and approaches, including demonstration activities • Support to institutions and advisory committees covering all sectors in support of a cross sectoral approach • Training on methods for coastal communities • Pilot projects in selected communities or with specific groups, including demonstration activities • Documentation and assessment of successes and failures of different

	the region (face-to-face and virtual networks, platforms) • Support to development of impact-oriented monitoring systems for adaptation activities, for use in CROPs and support to member countries on monitoring		approaches • Replication of successes in other locations or countries
Instruments (i.e. LTE, STE, consultancies, capacity building/training, in kind and financial contributions etc,)	• International long term experts • Financial contributions	• Long term experts (especially national long term experts as SPC staff) as country officers • Short term experts (international and national) • SPC ad-hoc support and advice (in kind) • Capacity building and trainings at national/regional level	• Financial support to NGOs, extension services, women's and farmers' groups etc. (in form of small grant scheme) • Long term experts (especially national long term experts as SPC staff) as country officers • Short term experts (international and national) • SPC ad-hoc support and advice (in kind) • Capacity building and trainings at national/regional level • Training of trainers for community level approaches

Expected outcomes and indicators for the different components are proposed as follows:
Component 1: "The capacities in climate change management of CROP agencies which are part of the institutional partnership architecture are strengthened"

Indicators:

- The concerned sectors of CROP agencies systematically integrate CC adaptation & mitigation concerns into its strategic approach & advisory services.
- X advisory products on climate change including mainstreaming LBNR developed and applied in SPC
- An innovative monitoring system on effects of adaptation advice is used by at least 1 division of a CROP agency
- Monitoring tool for PIFACC implementation is applied (SPREP)
- Climate change Portal for the Pacific established & jointly managed by CROPs
- Enhanced understanding of the effects of CC on tuna resources across the SPC statistical area/region
- Countries use high quality advice by SPC/SPREP on CC to take effective adaptation decisions (in ad-hoc requests)

Component 2: Mainstreaming adaptation to climate change and developing adaptation strategies.

Component Objective: Selected pacific countries have climate change adaptation strategies and mainstreaming processes in place to implement adaptation relating to LBMRNR & T according to agreed priorities and as an integral part of development and sectoral planning.
Indicators:

- National adaptation strategies or adaptation strategies for land and marine based natural resources are adopted by five countries, which have taken first steps to implement them;
- Existing strategies, planning documents and related processes related to natural resource management integrate climate change adaptation in five countries;
- Standard procedures for climate proofing development planning processes at national or subnational level are applied in three countries.

Component 3: Implementing priority adaptation measures, regarding natural resources, including at community level.
Component Objective: Selected Pacific countries have successfully implemented and assessed adaptation measures in relation to land or marine based natural resources, building up experiences and contributing to their adaptation priorities.
Indicators:

- Adaptation techniques, institutional arrangements, and priority adaptation measures related to land and marine based natural resources, and as identified in relevant national documents, are applied and implemented in at least eight countries on a pilot-basis.
- 20 communities have identified and partly implemented adaptation approaches in an integrated cross-sectoral manner, addressing gender and conservation concerns.
- Experiences from implementing adaptation in different countries are assessed and shared within the region on a continuous basis.

4.3 Coordination with other Technical Assistance

There are many donors with major technical assistance projects in the Pacific and it will be essential to have good coordination and cooperation with these donors and the projects that are being implemented. The Development Partners for Climate Change (DPCC) will be the major entry point for donor coordination, and in the course of kick-off workshops in each country the current state of donor initiatives will be reassessed.

The approaches proposed for this project are in line with the major approaches of other donors.

- The concept of integrating adaptation to climate change into development and development cooperation and the need for good policy frameworks are widely acknowledged in the region, as reflected in most donor approaches. Joint efforts by donors supporting the implementation of such strategies will be important.
- Approaches targeting communities are likewise widely accepted in the region. Guidelines and modes for accessing and implementing small grants, as established and introduced by these programmes, will be taken into consideration in the design of this project. Lessons learned across these programmes will be supported and stimulated.
- Coordination with donor programmes and projects targeting related sectors (agriculture and land use, fisheries and marine resources, conservation, food security, water management and disaster risk reduction) without a specific climate change focus will also be relevant as this project emphasizes integrating climate change in the respective sectors.

The specific contribution of the proposed project is the focus on adaptation to climate change with regard to land and marine based natural resources and the support to the integration of climate change concerns in CROP and SPC advice and services, with good reach and expertise in sectors.

Coordination with the following initiatives will be of particular importance:

Bilateral initiatives:

- Australia:
    - Pacific Adaptation Strategy Assistance Programme (PASAP): Strategy assistance, (countries will be identified at a later time)
    - Pacific Climate Change Science Programme with USP: Provision of improved climate information
    - The Pacific Future Climate Leaders Program will work to build a group of Pacific leaders with a greater understanding of climate change and tools to enhance resilience
    - Asia-Pacific community-based adaptation small grants programme: Community based adaptation, with established modalities for communities to access the small grants (with GEF)
    - Several programmes and projects targeting related sectors (agriculture, fisheries, food security, water management and disaster risk reduction) without a specific climate change focus

- New Zealand: NZAid has focused on mainstreaming adaptation climate change in its support programmes and projects in the relevant sectors
- US: The US, through USAid, and USDA, NRCS, and other relevant agencies (in addition to considerable financial support through compacts) is supporting mostly Micronesian PICs.
- Taiwan is involved in agricultural technological advise and aquaculture development in several countries, in support of increasing food fish production (mainly milkfish) for the local market (including Palau, Kiribati, Nauru).
- JICA; In the land and marine area, projects include capacity enhancement for coral reef monitoring in Palau and Vanuatu, a study for the assessment of ecosystem, coastal erosion and protection/rehabilitation of damaged area in Tuvalu, and the strengthening of community-based disaster management in Fiji and the Solomon islands.

Multilateral initiatives

- GEF:
    - Pacific Adaptation to Climate Change (PACC): Climate policy development (support to development of climate policy in several countries), Implementation of adaptation measures in priority areas/sectors with many projects related to infrastructure development; Implemented by SPREP in cooperation with UNDP in 13 Pacific countries)
    - Least Developed Countries Fund (LDCF): Projects in support of implementation of priorities identified in NAPAs are funded through the LDCF in a few LDCs (currently in Solomon Islands, xxx; implemented by Worldbank and UNDP)
    - UNDP's five-year "Community-Based Adaptation Projects" are funded by the Global Environment Facility (GEF). The GEF Small Grants Programme, AusAID, UN Volunteers, the Government of Japan and local NGOs are partners in this project.
- ADB:
    - Regarding adaptation to climate change, ADB follows mostly an approach to climate proof investments in relevant sectors, and supporting partner countries in this process. In Palau, for example, ADB supported the Palau Climate Change and Adaptation Road Map. While no projects are going on in agriculture or fisheries, in the water sector is supported.
- Worldbank Pilot Program on Climate Resilience (PPCR): This project takes a strategic approach to adaptation by providing grants and loans in support of country pilot programmes in climate resilience, which are being developed by the countries; it is implemented in Samoa. Papua New Guinea and Tonga.
- European Union:
    - Global Climate Change Alliance (GCCA): Integration of climate change concerns in development planning (including in Vanuatu)
    - EU is implementing disaster risk reduction projects in the region, likewise relevant to this project
    - The EU is looking to implement a climate change adaptation project in the seven LDCs, and this may be linked to the current GTZ project.
    - The EU plans to support PICs in the area of climate change and disaster reduction, through PIFS, through budget support.

4.4 Expected Impacts (impact chain) (with reference to OECD-DAC evaluation criteria)

Component 1: Capacity development in climate change in CROP agencies

A major area of support will be organisational development to technical CROP agencies and PIFS (Support to PIFS in mobilizing climate finance for the region; Support to SPREP to monitor and coordinate PIFACC, support to make the position of the Climate Coordinator in SPC operational, improved coordination and cooperation of CROP including through joint JCS taking into consideration climate change). A second area of support will be strengthening advisory capacities of technical CROP institutions (Trainings on adaptation skills within CROPs including on use of climate information products; development of advisory tools on adaptation techniques regarding LMBNR, provision of and training on climate proofing procedures, strategy development, priority setting; Studies and knowledge management on vulnerabilities to and impacts of climate change regarding LMBNR in the Pacific, including on specific species, crops, agricultural production systems etc., Support to development of impact-oriented monitoring systems for adaptation activities, for use in CROPs and support to member countries on monitoring). CROPs and relevant actors will be supported in improving learning and exchange in the region (face-to-face and virtual networks, platforms) (Outputs). Staff and organisational units in regional organisations will have stronger skills, networks and tools available and use these capacities to more effectively coordinate and provide services to member states on coping with climate change (Use of outputs). This leads to strengthened capacities in climate change management of CROP agencies which are part of the institutional partnership architecture (Direct Result).

Component 2: Mainstreaming adaptation to climate change and developing adaptation strategies

National coordinating bodies for adaptation to climate change and line ministries dealing with LMBNR and CCZM are supported in developing and operationalising national adaptation strategies for LMBNR (specialist inputs on adaptation strategy development including analyses of LMBNR related impacts and vulnerabilities, costing studies, provision of methods for prioritising adaptation options, policy advice and support to stakeholder consultation processes, proposals for adaptation strategies; Generation of knowledge and capacity building to stakeholders). They are further supported in integrating adaptation concerns into secotral planning, esp. agriculture, forestry, fisheries, water, and land use, and cross-sectoral plans, e.g. food security and disaster risk reduction strategies through specialist inputs on adaptation on sectoral impacts of CC and adaptation techniques and options, proposals on reviews of sector policies and plans to integrate climate change concerns, training on tools for climate proofing, development of guidelines and procedures for climate proofing; capacity building. Advisory services also concern subnational procedures for climate proofing standard procedures or regulations such as land use planning, local development planning, or resource management plans (Outputs). Coupled with the commitments of the countries concerned and the skills gained, national stakeholders use the information and proposals to agree high quality and thoroughly consulted adaptation strategies and/or to inform sectoral strategies, policies and plans at national and planning procedures at subnational level. Member states request and use climate services and information provided by CROP agencies for strategy development and integrating climate

change in the respective sectors (Use of outputs). As a direct result, countries have climate change adaptation strategies in place and mainstream adaptation to climate change across levels to implement adaptation relating to sustainable management of LMBNR according to agreed priorities and as an integral part of development and sectoral planning. (Direct result)

Component 3: Implementing adaptation to climate change activities at all levels, from government departments to communities

Line ministries dealing with LMBNR, which to date have very limited capacities on climate change, are supported in implementing adaptation priorities, developing institutional arrangements and applying adaptation techniques and approaches in the respective sectors (and cross-sectoral approaches).Communities are directly supported in planning, implementation and learning on adaptation. This is achieved through the design and application of appropriate adaptation activities supported through specific and targeted pilot projects, ensuring stakeholder participation at every stage to maximise ownership at all levels. Short term TA will be required to maximise the implementation of adaptation activities with capacity building within communities, especially targeting gender issues and disadvantaged groups (those most vulnerable). Through ongoing assessments of pilot projects that exhibit ownership by the communities involved, it will be possible to make changes or adjustments where necessary to maximise the success and sustainability of the adaptation intervention. Dissemination of results, both successes and failures, through a range of media (publications, videos, radio etc) is an integral part of the project to share lessons learned to maximise the impact of the project (Outputs). It is also anticipated that other communities will see the success of interventions and seek to undertake similar activities, with the project assisting, possibly through the promotion of a small grants scheme (Use of outputs). The project thus helps to reduce the negative impacts of climate change through assisting government departments and communities to adapt and build resilience to the effects of climate change. As a consequence, SPC Member State capacity for dealing with the impacts of climate change in many areas is strengthened as an integral component of the sustainable management of natural resources (Direct result).

4.5 Risk Analysis

Risk	Importance	Addressing risk	Can risk be influenced
Change of governments that lead to a change in climate change priorities and policy	Medium	• Maintain close linkages with the different sectors to maintain a high profile of CC adaptation activities. • Where possible, work with communities and private sector to broaden involvement of different actors	Medium Good communication and coordination will limit the effects of this risk.
Communities do not accept or lose interest in adaptation activities	Medium	• Capacity building to give people the skills needed to undertake activities • Ongoing assessment of success of activities with adjustments made where needed • Ongoing communication to address any concerns quickly	Yes, through good and clear communication and following up with the community.
Government	Medium	• Use consultative committees/bodies	

departments do not work together in implementing joint adaptation activities		wherever possible to bring government departments together	
Limited absorptive capacity in the region leads to delays and lack of quality and impacts	Medium	• Provide sufficient personal resources for activities and work through established structures with limited load on small countries • Assess absorptive capacities and risks to sustainability thoroughly case by case	High
Political instability	Medium	•	Low

5 Cost Estimates for Proposed TA

It is proposed that Components 1 to 3 account for approximately 75-80% of the project's budget.

ANNEXES

Annex 1: Key vulnerabilities of PICs as identified in NAPAs

Country	Key Vulnerabilities
Kiribati	○ Stress on environmental systems: coasts, water resources, infrastructure, coral reefs, forests and trees, agriculture, etc. ○ Human settlements, land and coastal areas: loss of land through erosion, storm surge ○ Agriculture – saltwater intrusion induced by sea-level rise and storm surge and wave-overtopping ○ Water resources – saltwater intrusion into freshwater lens ○ Infrastructure – high risk of damage to key infrastructure from storms, erosion, wave over-topping ○ Biodiversity – negative impact on terrestrial and marine ecosystems –e.g. coral reef ○ Health – incidence of vector- and water-borne diseases
Samoa	○ Agriculture & Food Security-Instability of food production levels caused by climate induced disasters. ○ Water is often affected by drought and saltwater intrusion induced by sea-level rise ○ Health – high incidence of vector- and water-borne disease due to changes in rainfall and temperature. ○ Biological diversity – affected by droughts and tropical cyclones. ○ Forestry – high risk of fires during drought and dry seasons. ○ Coastal infrastructure and environment – sea-level rise, storm surges and coastal erosion and inundation. ○ Tourism – loss of beaches, inundation and erosion. ○ Urban settlement – poor design and lack of proper planning. ○ Village communities – loss of homes and property (cultural values) and livelihood
Solomon Islands[2]	○ Agriculture and food security – loss from droughts, flooding, incidences of pests and diseases, saltwater intrusion, coastal erosion/land loss/inundation ○ Water resources – especially on small low-lying islands with saltwater intrusion, wave-overtopping, flooding on high islands ○ Human health – incidence of vector-borne and water-borne diseases, tropical cyclones ○ Infrastructure and human settlements – loss of buildings and property, cultural sites, etc ○ Coastal zones and resources – erosion, land loss/inundation, effect on tourism development. ○ Fisheries – effect of migratory pattern of tuna fishery and impact on fishing as an economic activity
Tuvalu	○ Water resources – esp.. groundwater resources affected by saltwater intrusion, drought ○ Health and well-being – affected by incidences of water-borne diseases, and drought ○ Subsistence, agriculture and food security – saltwater intrusion and incidence of fruit fly and coconut scale pest ○ Coastal areas and erosion - effect of tropical cyclones, storm surges.

[2] Information extracted from Initial National Communication (2004).

	○ Fisheries – effect of coral bleaching on fisheries resources, migration of warm water for tuna fishery ○ Disasters – drought, tropical cyclones, coastal flooding, etc, high sea surface temperatures, sea-level rise, coastal erosion/inundation/loss of land.
Vanuatu[3]	○ Water resources – drought and floods, saltwater intrusion on low-lying islands ○ Coastal zones and resources – erosion, storm surges, loss of land ○ Infrastructure and settlement – loss of key infrastructures during cyclones, loss of homes and property, effect on tourism development, etc ○ Agriculture and food security – drought, sea-level rise, saltwater intrusion, flooding , incidences on pests and diseases. ○ Fisheries and marine resources – effect of coral damage on loss of fishery resource, warming of seawater on coral reef. ○ Forests and land management – effect of sea-level rise, increase in temperature on phonological cycle of fruit trees and crops, incidences of invasive and other pests.

[3] Extracted from Final Draft of National Adaptation Programmes of Action (2007)

Annex 2: Ongoing climate change and fisheries activities

Current Climate Change Programmes, Projects	Donors	Duration	Budget (Funding, Co-Funding)	Expected results	Regional Coverage (Countries)	Implementing Agencies/Institutions (regional, country level)
Pacific Adaptation to Climate Change project (PACC)	UNDP/GEF			1. Enhanced adaptive capacity of key economic sectors 2. National policies and programmes in above economic sectors integrate adaptation to climate change priorities 3. Regional cooperation promoted	Cook Islands, Federated States of Micronesia, Samoa, Vanuatu, Fiji, Papua New Guinea, Solomon Islands, Nauru, Niue, Tonga, and Tuvalu	SPREP
Research project on the potential impact of climate change on fisheries and aquaculture in the Pacific	AusAID	2008 to 2010	AusAID, AUD $1.0 m	1. Pacific fisheries and climate change: a vulnerability assessment report. 2. Identify adaptation and management needs to maintain the benefits of fisheries. 3. Assess regional capacity to forecast and mitigate effects of climate change on fisheries 4. Identify priorities for assistance to address the effects of climate change on fisheries	All 22 Pacific Islands countries and territories	SPC with around 70 experts working in groups on different chapters of the book
Communicating the key messages from the vulnerability assessment to policy-makers and stakeholders.	AusAID	2010 to 2011	AusAID, AUD $175,000	1. Dissemination of vulnerability assessment as a book and CD 2. Produce policy briefs and other awareness-raising information based on the findings of the assessment	All 22 Pacific Island countries and territories	SPC
Monitoring the vulnerability and adaptation of	AusAID	2010 to 2012	AusAID, AUD $995,000	1. Inform national decision-makers on coastal fisheries and climate change. 2. Provide a framework for assessing	All 22 Pacific Island countries and territories, with up to	SPC with partners

coastal fisheries to climate change				the vulnerability of coastal fisheries habitats and fisheries across the region 3. Identified monitoring protocols trialed in pilot projects for assessment.	5 pilot projects in yet-to-be-identified PICTs	
Sustainable harvesting of aggregate from Tarawa lagoon	EU	2008 to ???	EU, Euro 2.2 million	?	Kiribati	SOPAC, Government of Kiribati
Annual funding for responding to requests for development and disaster assistance	Taiwan/ROC	Annual allocation	Taiwan, AUD $300,000	To respond to disaster proposals from the outer islands e.g. for coastal erosion (need for sea walls) and salt water intrusion effecting crops etc	Kiribati	Kiribati Government
Ecosystem-based management in Palau	Mc Arthur Foundation	3 year period	Mc Arthur Foundation USD $1,018,000	To foster healthy coastal communities and ecosystems in Babeldaob and to develop a collaborative process to improve natural resource management.	Palau	Palau Conservation Society (PCS) with partners: PICRC, EQPB, Belau National Musium (BNM)
GEF Small Grants Project	GEF	Ongoing	GEF, up to USD $50,000/project	Community Based Projects that address Climate Change, Biodiversity, and Desertification	Palau	Palau International Coral Reef Center (PICRC), PCS, BNM, Palau Community Action Agency (PCAA)
Micronesian Challenge	The Nature Conservancy (TNC) and Conservation International (CI)	Open and ongoing	TNC: USD $3 million, CI: $3 million increasing to $18 m	Micronesia Challenge is a formal sub-regional commitment to effectively conserve 30% of the marine and 20% of the terrestrial resources by the year 2020. The funds will be used to form the Protected Areas Networks throughout the region.	Republic of Palau, Federated States of Micronesia, the Republic of the Marshalls, the US Territory of Guam and the Commonwealth of the Northern Marianas.	Republic of Palau, Federated States of Micronesia, the Republic of the Marshalls, the US Territory of Guam and the Commonwealth of the Northern Marianas, through in-country partners in each location.
Marine protected area project	NOAA and Packard Foundation	Open and ongoing	No funding specified	Marine Protected Areas have been established throughout Palau and PICRC has conducted ongoing monitoring of	Palau	PICRC and PCS

				fish and coral within MPA. In addition, PICRC is addressing the socio-economic aspects of MPAs. This program has quantified recovery of corals after the 1998 El Nino-La Nina event.		
Palau National Biodiversity Strategy and Action Plan (NBSAP)	GEF	For first and second Communication – no timeframe specified.	GEF USD $270,000 plus top-up funding for second Communication	The plan addresses protected and managed areas, species protection, sharing benefits of genetic resources, agricultural biodiverstiy (agrobiodiversity) and mainstreaming Conservation.	Palau	OERC, Minstriy of Resources and Development, PICRC, Palau Automated Land and Resource Information System (PALARIS), EQPB, PCS, PCC Land Grant Program Governors Association, Council of Chiefs, BNM, TNC, TEI
Pacific Adaptation to Climate Change	GEF	2010–2013	GEF: USD $800,000 plus additional funding	Agricultural and Aquaculture Sustainability, Biodiversity Protection, Sustainable Management of Mangroves to address food security	Palau	Ngatpang State, PALARIS, Bureau of Agriculture, PCS, PCC Cooperative Research and Extension, PCAA, OERC
Protected Areas Network	TNC	Open and ongoing	TNC: USD $1 million	The Protected Areas Network consists of marine and terrestrial areas throughout Palau that have been designated for protection by either the national government, state government or community.	Palau	Ministry of Administration, Ministry of Resources and Development, PCS, TNC, National Congress, Association of Governors, Council of Chiefs, PALARIS
Enhancing coastal and marine ecosystems resilience to climate change impacts through strengthening coastal governance	MacArthur Foundation	2009 to 2011	MacArthur Foundation: USD $165,000	Project purpose is to strengthen the capacity of national government and communities in Vanuatu, to respond to climate change impacts in coastal areas through the application of integrated coastal management and conservation based adaptation measures.	Vanuatu	Fisheries department of Vanuatu on behalf of the National Advisory Committee on climate change with assistance from SPREP

and conservation measures						
Mangrove ecosystems for climate change and livelihoods	German Government BMU	2009–2013	BMU: Euro 2.3 million	Project goal is to help participating countries invest in stakeholder based management of mangroves and associated ecosystems, informed by interdisciplinary applied action research outputs and where appropriate supported by traditional knowledge.	Samoa, Fiji, Tonga, Solomon Islands and Vanuatu.	IUCN with partners including SPREP, WorldFish and USP
Biodiversity, ecosystem services and climate change in the Pacific Islands region.	AusAID	2009–2011	AusAID: AUD $300,000	Scoping exercise to identify what assessments and activities have been done and what should be undertaken further.	Regional scoping exercise	SPREP through consultancies
Coral triangle initiative on coral reefs, fisheries and food security (CTI)	ADB, GEF, AusAID USAID, WWF, TNC, CI and many others	2007–?? (ongoing)	Over USD $350 million pledged from donors	Establish plans for strengthening policies and institutions, and set goals and targets for the 1. Designation and management of priority landscapes 2. Application of an "ecosystem approach" to the management of fisheries and marine resources 3. Establishment of networks of marine protected areas 4. Introduction of measures to strengthen to adapt to climate change 5. Protection of threatened marine species.	Philippines, Indonesia, Malaysia, Timor-Leste, Papua New Guinea and Solomon Islands. Other Pacific countries may be added.	Multiple agencies and NGOs as well as the participating countries.

Annex 3: People consulted during the mission by country

In Fiji

- Mr Solo Mara, Permanent Secretary, Ministry of Foreign Affairs, International Cooperation and Civil Aviation, Government of Fiji
- Mr Shaheen Ali, Acting Director, Economics and Trade Division, Ministry of Foreign Affairs, Government of Fiji
- Ms Setaita Tupua, Economic Planning Officer, Ministry of Foreign Affairs, Government of Fiji
- Mr Wiepke van de Goot, Head of Delegation, Delegation of the European Commission for the Pacific
- Ms Annick Villarosa, Head of Natural Resources, Delegation of the European Commission for the Pacific
- One other person (female) from EU
- Mr Shinya Tamio, Assistant Resident Representative, Japan International Cooperation Agency (JICA), Fiji Office (Tamio.Shinya@jica.go.jp)
- Mr Minoru Tamura, Project Formulation Adviser (Environment) JICA, Fiji Office (Tamura.Minoru@jica.go.jp)
- Mr Fumiaki Saso, Project Formulation Adviser (Environment) JICA, Fiji)ffice (Saso.Fumiaki@jica.go.jp)
- Professor Patrick D. Nunn, Pro Vice Chancellor (Research and Innovation) University of the South Pacific, Suva, Fiji
- Mr Jai Karan, Director, Development Marketing and Communications, University of the South Pacific, Suva, Fiji (Karan_j@usp.ac.fj)
- Ms Kerry Mara, Development Manager, Development Marketing and Communications, University of the South Pacific (mara_k@usp.ac.fj) (679 323 2615)
- Mr Jens Kruger, Physical Oceanographer, Oceans and Islands Programme, Pacific Islands Applied Geoscience Commission (SOPAC), Suva, Fiji (jkruger@sopac.org)
- Mr Paul Fairbairn, Manager, Community Lifelines Programme, SOPAC, Suva, Fiji
- Mr Rupeni Mario, Energy Adviser, SOPAC, Suva, Fiji
- Ms Coral Pasisi, Regional and International Issues Adviser, Pacific Islands Forum Secretariat, Suva, Fiji (coralp@forumsec.org.fj)
- Dr Jimmie Rodgers, Director General, Secretariat of the Pacific Community (SPC), Noumea, New Caledonia
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Annex 4: Country assessment as identified during scoping – FOR INTERNAL USE ONLY

PIC	Partner Interest and Capacity	Natural Environment	Intensity and Relevance of Climate Issues	Potential to fit in with existing Programmes and Donor activities	Practicality, Feasibility
Fiji	Interest medium + Capacity high ++ Absorptive capacity ++	Mostly high-lying, large islands	Soil erosion associated with heavy rains; increasing vulnerability of marine ecosystems Vulnerable densely populated deltas Cyclones	GTZ Climate Change Adaptation Programme Working already on Land Use Planning and National Adaptation Strategy/Database for Land Based Natural Resources	++
Tonga	Interest medium Capacity rel low 0 Absorptive capacity 0	Low-lying atolls and high islands	SLR, Drought	GTZ Climate Change Adaptation Programme Working already on Land Use Planning and National Adaptation Strategy/Database for Land Based Natural Resources	+
Vanuatu	Interest very high ++ Capacity rel low 0 Absorptive capacity ++	Mostly high islands	Soil erosion, cyclones, marine ecosystems	GTZ Climate Change Adaptation Programme Working already on Land Use Planning and National Adaptation Strategy/Database for Land Based Natural Resources	++ (already GTZ Technical advisor)
Kiribati	Interest very high ++ Capacity rel low 0 Absorptive capacity 0 (many donors, but good opportunities for alignment/donor coord.)	Low-lying atoll islands Limited agricultural options	Coastal erosion, marine resources depletion, water availability and quality/drought, salt water intrusion, high population density in Tarawa LDC ++ (SLR, Drought) Senile coconut trees	CCS (Climate Change Strategic Framework), NAPA + KAP 2 (WB, GEF, AusAid) on water and coastal erosion AusAid to develop ICCAI project ADB working on water/sanitation/infrastructure EU on water and solar energy, DSAP Centre of Excellence Taiwan: Agriculture, DRR ++	0
FSM	Interest 0 Capacity + Absorptive capacity +	Low-lying atolls and high islands with agriculture/ forestry	Atolls most vulnerable, Strong marine resources degradation, Trying to reach LDC status + Kosrae 0 Chuk ++ (SLR, El Nino) Pohnpei + (incl. erosion) Yap 0 to +	Climate Policy with deadlines for mainstreaming Food Policy to be developed + EU: Energy Japan: Cool Earth US Compact SPREP: PACC: Kosrae 0	++ (SPC regional office)
Palau	Interest ++	Very small islands	Sea level rise, droughts, inundation	Broad, GEF, foundations, NGOs (TNC/CI)	++

	Capacity ++ (?) Absorptive capacity -/0 (very small)		+	+	
Marshalls	Interest very high ++ capacity low + Absorptive capacity 0	Low-lying atoll islands	Drought, cyclones, coastal erosion, saltwater intrusion water quality and access overfishing ++	GEF-PACC project, SLM programme, GEF-Small Grants Programme, strong US Presence 0	0
Solomon Islands	Interest ++ Capacities ++ Absorptive capacity ++	Larger country high islands with agriculture/ forestry, some atolls	0	? – to be completed by team visiting SI	?
Papua New Guinea	Interest ? Capacities +? Absorptive capacity +?	Very large country in the region high islands with forestry/ agriculture	0	? – to be completed by team visiting PNG	?
Nauru	Interest 0 Capacity + Absorptive capacity -	Very small islands	Drought, cyclones, saltwater intrusion, overfishing ++	AusAID: Fisheries, EU: Fisheries, Agriculture (partly with FAO), Japan: Fisheries, Taiwan: Aquaculture and other, GEF/SOPAC: water, UNDP: Community work, SLM	-
Samoa	Interest 0 Capacity + Absorptive capacity - /+ (many donors on CC)	Small islands, but high-lying	Cyclones, coastal erosion +	Strong donor engagement (World bank, UNDP, AusAID, NZAID, JICA) Good coordination required	++
Tuvalu	Interest + Capacity 0 Absorptive capacity 0	Low-lying atoll islands, limestone islands	Sea level rise, drought, cyclones Atolls most vulnerable ++	EU: Water ADB GEF/UNDP	0

++ high + considerable 0 really not sure - very little

Annex 5: Proposed Approach in Countries - examples

	Kiribati	Marshall Islands	FSM
Proposed Project Component	**Mainstreaming of CC adaptation into natural resource policies and management** Mainstreaming at policy level, based on upcoming Climate Change Strategic Framework/Strategy; Support for sustainable mgt and conservation of marine and land resources (coordinated approaches between ministries, best practices, community focus)	**Integrating climate change concerns into water and natural resources management** Water Resource Management to adapt to CC and SLR Support to implementation of natural resources and climate change related parts of Disaster Risk Reduction and Energy Plan;	**Food security and climate change** Mainstreaming at policy level, based on Climate Policy (issued Nov. 09); Support with costing, prioritising and implementing selected measures from ongoing Vulnerability and Adaptation Assessment (as part of Second National Communication); Gender
Counterparts (including important donors)	Climate Change Office at the Office of the President MELAD (Ministry of Environment, Land, Agriculture), Fisheries AusAID, EU	Ministry of Research and Development; Office of Environment Planning and Policy Coordination US EPA; Office of Environmental Planning and Policy Coordination	Office of Environment and Emergency Management; Department of Resources and Development States Focal Points (Environment Dep, Yap: Office of Planning and Budgets); Working through NGOs (e.g. Conversation Society FSM)
Modes of support	International/regional climate change expertise; support demonstration sites (e.g. nurseries; demonstration farms); Capacity development; Support for implementation of elements from Climate Change Strategic Framework/Strategy; Community-based approaches, considering gender	International/regional climate change expertise; support demonstration sites; Capacity development; Support for implementation of relevant adaptation strategies; Community-based approaches, considering gender	Strengthening of coordination between national and states level on adaptation, Providing regional expertise through direct cooperation with SPC regional office Community based approaches, considering gender
Requests from Member countries	Water (quality and quantity), Agriculture/Fisheries, Mainstreaming CC (policy level) Coastal Erosion	Energy Water Food security Integrated approaches at community level Overarching Climate Policy	Food security, Water in Atolls, Energy (Mitigation), Mainstreaming into Sector Policies, Work with NGOs, States/Adaptation Strategies

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Annex 6: Climate Information in the Pacific – Collection and Use. The example of coastal zone (the physical environment)

provided by Jens Kruger, SOPAC

What are key information products/processes at regional level related to climate change **in the coastal zone**? Who are the key providers?
Gap analysis: What is missing for effective adaptation to climate change **in the coastal zone**?

	Climate (stimuli) related data/information (e.g. wind, sea level, precipitation)	**Vulnerability related data/information** (e.g. topography, derived indices)	**Impact related data/information** (e.g. biodiversity, livelihoods (incl. agriculture/fishery), infrastructure, settlements
Baseline data/ Monitoring/ Observation	**Key products:** wind speed and direction, sea level, sea surface temperature, ocean surface currents, ocean colour data, ocean surface wave height and direction. **Key providers:** Satellite observations and derived products for wave heights, wind, sea level anomalies, and sea surface temperatures (e.g. www.aviso.oceanobs.com). Global atmosphere-ocean models for waves and winds (e.g. www.ecmwf.int). Sea level data from observations of Pacific tide gauges (e.g. SPSLCMP) and sea surface temperature from ARGO floats. Key providers of analysis and visualisation software are e.g. the European Space Agency (e.g. http://earth.esa.int/resources/softwaretools/) **Gaps:** The Pacific Ocean covers a large part of the globe, individual Pacific islands are remote, and observational data, especially *in situ* data, are very expensive	**Key products:** high-resolution shallow water bathymetry (0-30m), high-resolution coastal topography, seamless coastal terrain models, high-resolution satellite imagery, **Key providers:** SOPAC for bathymetry, SOPAC for topography, SOPAC for satellite imagery. **Gaps:** There is a widespread need for more and better data to collected in the coastal zone. The single most cited need amongst member countries is for shallow bathymetry, coastal topography, and high resolution satellite imagery. This is the basic geospatial framework for almost all adaptation studies and derived products. There is a need for additional funding to collect this extremely important baseline geospatial data in populated and vulnerable areas as mapping costs and map accuracy are directly related.	**Key products:** for land: human population. For both terrestrial and marine environments: public and private infrastructure, bottom types, habitat type, shallow geology. **Key providers:** SOPAC and IRD for marine habitats, SPC for fisheries data, SOPAC for vegetation. SOPAC for geosciences related information. **Gaps:** The paucity of high-quality maps and charts in the coastal zone is a severe impediment to assessing the effects of complex natural and anthropogenic forces, including climate change. The reality of data integration in the coastal zone is extremely challenging. It must be derived from multiple sources of information, at the base of which must be accurate geospatial data (seamless coastal terrain models). Demands for these thematically rich data remain unfulfilled due to cost of data

	to collect. Realistically, this requires a focus and reliance on satellite-derived and computer-modelled data. While remote sensing applications are promoted through global projects (e.g. www.earthobservations.org), there has been limited uptake in the Pacific of these tools. Data can be expensive (e.g. ECMWF charges for volume), difficult to manage due to old computer hardware and poor storage capacity, and hard to access due to slow internet connections. There is also limited awareness amongst users (e.g. fisheries, meteorology, environment dept.) of these tools and knowledge.		acquisition, data post-processing, and data fusion software, as well as digital storage limitations. Satellite remote sensing may provide information, but knowledge of available data, their sources, and derived products is limited in the Pacific and at regional organisations.
Analysis, incl. scenarios	**Key products:** Regional and down-scaled scenario products for winds, precipitation, wave climate, temperature, cyclone intensity, etc. **Key providers:** Numerical modelling centres running global climate models and regional models (e.g. CSIRO in Australia, and DPRI, Kyoto Uni., Japan). Global conglomerate databases (e.g. CLIVAR). **Gaps:** lack of formal assessments for the Pacific region, e.g. the likelihood of future wave climate variabilities, trends and extremes under climate change, and how this may impact on shoreline vulnerabilities in the Pacific. Data volumes produced by global models are generally very large, and SOPAC currently does not have access to these datasets or the computing power to analyse these. Member countries would benefit if some training or collaboration could be provided through a regional centre such as	**Key products:** Easy access to up-to-date digital, geospatial data, imagery, and mapping and charting products (e.g. repeat surveys of coastal erosion/accretion following extreme events). Historical airphoto analysis showing coastal evolution and shoreline stability over decadal scales. Output from regional or downscaled climate models could provide information on likely future trends in the coastal zone. **Key providers:** SOPAC has the capacity to carry out conventional land and coastal surveys. High-resolution satellite imagery is increasingly used to capture impacts of extreme events and in conjunction with historical aearial photography provides monitoring over time spans of years to decades. Archives in the US, NZ, and AUS hold a wealth of historical aerial photography. Regional and European centres of climate expertise.	**Key products:** Easy access to up-to-date digital, geospatial data, imagery, and mapping products (e.g. terrestrial and marine habitat maps). **Key providers:** SOPAC for terrestrial and marine maps and charts, SPC for marine habitat maps. **Gaps:** understanding inter-annual and decadal variability of habitat data (terrestrial and marine), as well as trends in coastal development, and resource use (e.g. aggregates, fisheries) and possible longer term changes are important for coastal zone management and adaptation assessments in the Pacific. This information does not exist and can only be gained by collating, rectifying, and analyzing historical aerial photos and modern high-resolution satellite imagery (e.g. changes in mangrove cover, built infrastructure, shoreline changes, seagrass cover).

	SOPAC to kick-start the use, analysis and application of emissions scenario data on a regional basis. Many centres of expertise (e.g. CSIRO, NIWA) also downscale global data to look at impacts at coastline or island scales. This is currently not done for any Pacific Island Country.	**Gaps:** Timely and accurate topographic data following extreme events is not available due to lack of survey equipment (e.g. terrestrial LiDAR scanning), and cost of surveying remote locations. Cost of satellite data is often affordable now but collecting ground truthing data to rectify timely satellite imagery, add-value, and be able to compare historical imagery lacks resources (travel costs and high demand on staff especially following cyclones and flooding).	
Decision-making support (e.g. early warning)	**Key products:** Coastal hazard maps showing flood boundaries and depth of inundation (e.g. 1 in 100 year extreme event including greenhouse gas scenarios). These take into account storm surge, wave run-up, and are derived from coupled 2D wave and storm surge models that are based on statistical databases of extreme events (e.g. distant swell events or cyclone return intervals). **Key providers:** SOPAC currently has the computer models, tools and staff capacity to provide these and communicate them effectively to communities, local and national government for mainstreaming into policy (evacuation, building codes, adaptation, etc.) Early warnings at an operational level are only provided by the large global meteorological centers (e.g. ECMWF) through assistance of the WMO (e.g. south pacific severe weather forecasting demonstration project, SPSWFDP).	**Key products:** Easy access to up-to-date digital, geospatial data, imagery, and mapping and charting products as well as modelling products (e.g. maps showing areas of chronic erosion, or areas prone to erosion during El Nino events). Products and legislation that place set-back zones, building codes, resource use solutions. **Key providers:** SOPAC for production of maps and charts esp. relating to impacts of extreme events, and tools providing adaptation and development aids in the coastal zone (e.g. Niue sustainable coastal development policy). **Gaps:** Lack of resources to access, collate, and analyse available information (e.g. historical aerial photography, and modern high-resolution satellite imagery) and build geospatial baselines to support decision making. Lack of political will at the national level. Reluctant uptake of	**Key products:** Numerical model products such as ocean and lagoon circulation to determine impacts of changes in infrastructure development (e.g. dredging of shipping channel, land reclamation) and climate induced impacts (change in wave climate, ie. Wave direction) on coastline stability, water currents, sediment transport, reef health, etc. **Key providers:** Mandate sits with regional organisations such as SOPAC and SPC. One good example using remote sensing tools is the coral bleaching is coralreefwatch.noaa.gov **Gaps:** The paucity of pre-requisites such as baseline data, derivative products, and their analysis and trends over time compounds the difficulties in producing decision making tools and early warning systems. Satellite remote sensing products could provide information, but knowledge of available products and

	Gaps: Flood hazard maps can be generated at SOPAC based on high-resolution imagery, high-resolution and seamless bathymetry and topography (coastal terrain models), as well greenhouse gas emissions scenarios (e.g. sea level rise and variability, increased storm intensity, El Nino events, wave climate) and therefore require, as a prerequisite, almost all other products mentioned in this table. Regional and European centres of climate expertise hold a wealth of information pertaining to climate change predictions. These have not been analysed for the Pacific region or downscaled and communicated adequately. Member countries would benefit of more climate related information other than sea level rise (which is where the main focus is at the moment), for example trends for extreme events and return intervals for wave heights and storm surge.	policy and legislation at the community level due to importance placed on short term economic gain over long term sustainability as well as poor resource base (e.g. land issues). Findings must be effectively communicated to improve understanding at political and community level.	data sources is limited in the Pacific and at regional organisations.

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