



PACIFIC ADAPTATION TO CLIMATE CHANGE

**FEDERATED STATES OF MICRONESIA
(FSM)
KOSRAE STATE**

REPORT OF IN-COUNTRY CONSULTATIONS

Table of Contents

<u>Subject</u>	<u>Page</u>
1. Introduction	3
1.1 The need for adaptation to climate change	3
1.2 Objectives of Pacific Adaptation to Climate Change	5
1.3 Scope of report	5
2. General Overview	6
2.1 Situation analysis	6
2.2 Stakeholder analysis	8
2.3 Climate change programmes, project and activities	9
3. Sectoral Analysis	10
3.1 Methodology/criteria for selection of priority sector	10
3.2 Assessment of priority sector for adaptation activities	11
3.3 Current institutional and development baseline	12
3.4 Impacts of climate change on priority sector	12
3.5 Method for assessing priority sector baseline	13
4. Mechanism for delivery of full-sized project	13
4.1 Institutional arrangements	13
4.2 Assessment of existing and potential barriers to Implementation of adaptation within Priority sector	14
5. Expected goals, outcomes, outputs and activities for adaptation	14
References	
Annexes	
Letter of co-financing	
List of experts and institutions consulted	

I. INTRODUCTION

1.1 The need for adaptation to climate change

1. Small island developing States (SIDS) are highly vulnerable to climate change and sea level rise owing partly to their small land masses surrounded by ocean, and their location in regions prone to natural disasters. SIDS are often characterized by having relatively large populations for the area they occupy with high growth rates and densities; poorly developed infrastructure and limited natural, human and economic resources, and their high dependence on marine resources for their livelihood needs. Most of their economies are reliant on a limited resource base and are vulnerable to external forces, such as changing terms of trade, trade liberalization, and migration flows. Adaptive capacity to climate change is generally low.

2. In the Pacific region where the Federated States of Micronesia (6° 55' N, 158 15' W) is situated, the climates are influenced by a number of factors such as trade wind regimes, the paired Hadley cells and Walker circulation, seasonally varying convergence zones such as the South Pacific Convergence Zone (SPCZ), semi-permanent subtropical high-pressure belts, and zonal westerlies to the south, with the El Niño Southern Oscillation (ENSO) as the dominant mode of year to year variability (Fitzharris, 2001; Folland *et al.*, 2002; Griffiths *et al.*, 2003). The Madden-Julian Oscillation (MJO) also is a major mode of variability of the tropical atmosphere-ocean system of the Pacific on times scales of 30 to 70 days (Revell, 2004), while the leading mode with decadal time-scale is the Interdecadal Pacific Oscillation (IPO) (Salinger *et al.*, 2001E. A number of studies suggest the influence of global warming could be a major factor in accentuating the current climate regimes and the changes from normal that come with ENSO events (Hay *et al.*, 2003; Folland *et al.*, 2003).

3. Recent studies in the southern Pacific region show that the annual and seasonal ocean surface and island air temperatures have increased by 0.6 to 1.0°C since 1910 throughout a large part of the South Pacific, southwest of the South Pacific Convergence Zone (SPCZ) where as decadal increases of 0.3 to 0.5°C in annual temperatures are only widely seen since the 1970, preceded by some cooling after the 1940, which is the beginning of the record, to the northeast of the SPCZ (Salinger, 2001; Folland *et al.*, 2003).

4. Analyses of trends in extreme daily rainfall and temperature across the South Pacific for the period 1961 to 2003 show significant increases were detected in the annual number of hot days and warm nights, with significant decreases in the annual number of cool days and cold nights, particularly in years after the onset of El Nino, with extreme rainfall trends generally less spatially coherent than were those of extreme temperature (Manton *et al.*, 2001; Griffiths *et al.*, 2003). The maximum number of consecutive dry days is decreasing and the number of heavy rainfall events is increasing which is consistent with changes reported from global analysis of daytime and nighttime temperatures.

5. Variations in tropical cyclones, hurricanes, typhoons in all small islands' regions are dominated by ENSO and decadal variability which result in a redistribution of tropical storms and their tracks, so that increases in one basin are often compensated by decreases in other basins. For instance, during an El Niño event, the incidence of tropical storms typically decreases in the far western Pacific and the Australian regions, but increases in the central and eastern Pacific while during La Nina the trend reverses. The numbers and proportion of hurricanes reaching category 4 and 5 globally have increased since 1970, while total number of cyclones and cyclone days decreased slightly in most basins which is consistent with the trends observed in the Pacific islands region. Additionally, in the tropical South Pacific, the distribution of tropical storms and their tracks are dominated by ENSO and decadal

variability, with small islands to the east of the dateline highly likely to receive a higher number of tropical storms during an El Nino event compared to a La Niña event and vice versa (Brazdil *et al.*, 2002).

6. Past studies of adaptation options for small islands have been largely focused on adjustments to sea-level rise and storm surges associated with tropical cyclones. There was an early emphasis on protecting land through ‘hard’ shore-protection measures rather than on other measures such as accommodating sea-level rise or retreating from it, although the latter has become increasingly important on continental coasts. Vulnerability studies conducted for selected small islands (IPCC, 2001) show that the costs of overall infrastructure and settlement protection is a significant proportion of GDP, and well beyond the financial means of most small island states. More recent studies since the TAR have identified major areas of adaptation, including water resources and watershed management, reef conservation, agricultural and forest management, conservation of biodiversity, energy security, increased share of renewable energy in the energy supply, and optimized energy consumption. Proposed adaptation strategies have focused on reducing vulnerability and increasing resilience of systems and sectors to climate variability and extremes through mainstreaming adaptation.

7. While small islands must adapt to the consequences of climate change, their adaptive capacity is limited and is being further eroded by external factors such as the internationalisation of economic activity and internal population pressures. People in small islands have historically adapted to variability in climate and sea conditions. It is not clear how valuable this experience will be in dealing with the longer-term mean changes in climate and sea level, especially since traditional mechanisms for coping with environmental hazards are being lost in many islands.

8. The need to implement adaptation measures in small islands with some urgency has been recently reinforced by Nurse and Moore (2005), and was also highlighted in the TAR where it was suggested that risk-reduction strategies together with other sectoral policy initiatives in areas such as sustainable development planning, disaster prevention and management, integrated coastal zone management and health care planning should be employed. Since then a number of projects on adaptation in several small island states and regions have adopted this suggestion. Projects aim to build capacities of individuals, communities and governments so that they are more able to make informed decisions about adaptation to climate change and to enhance their adaptive capacity in the long run.

9. Given the urgency for adaptation in small island states there has been an increase in *ad-hoc* stand alone projects, rather than a programmed or strategic approach to the funding of adaptation options and measures. It can be argued that successful adaptation in small islands will depend on supportive institutions, finance, information and technological support. Thus an adaptation strategy for the Pacific islands and indeed for the Federated States of Micronesia should include a strategy for precautionary adaptation since it is difficult to predict far in advance how climate change will affect a particular site, sector or community. Thus adopting a “no regrets” adaptation measures would be justified even in the absence of climate change, as this would more than likely lead to better management of natural resources and sustainable development.

1.2 OBJECTIVES OF PACIFIC ADAPTATION TO CLIMATE CHANGE (PACC).

10. Given the foregoing urgency for the need for adaptation to climate change in the Pacific island countries, a Pacific Adaptation to Climate Change (PACC) has been developed to assist with the implementation of adaptation measures in 11 countries of the region. Micronesia, as one of the

participant countries will participate in the PACC implement adaptation measures to enhance its resilience to the adverse impacts of climate change in the longer term.

11. The principal objective of the PACC is to facilitate the implementation of long-term adaptation measures to increase the resilience of a number of key development sectors in the Pacific island countries to the adverse impacts of climate change. A framework for PACC (PACC framework) will be developed through a consultative process involving all relevant stakeholders (including national governments and their respective agencies, institutions, departments and ministries, and non-government organizations, where appropriate, CROP agencies, donor partners, private sector, where appropriate, and others deemed necessary). The PACC framework will guide the implementation of the PACC at the national (including community and/or village) and regional levels.

1.3 SCOPE OF THE REPORT

12. As one the of the key outcomes of the in-country consultations is to determine detailed adaptation activities and baselines in each country, this report provides the outcomes of the Micronesia in-country consultations on PACC which were held from October 02-06 2006. The report is divided into five sections: section I outlined the urgency for adaptation to climate change in SIDS, building on the IPCC third assessment report; section 2 provides a general overview of the climate change and development situation (situation analysis) in Micronesia covering issues relating to assessment of impacts of climate change on the biophysical and human systems and stakeholder analysis; section 3 covers sectoral analysis with regard to a methodology and/or a criteria used to select a priority sector for adaptation intervention, institutional and development baselines within the priority sector as well as the analysis of the impacts of climate change within the priority sector; section 4 provides information of the delivery mechanism for full-sized project implementation of the Micronesia component of the PACC and section 5 covers the project goals, outcomes, outputs and activities. The letter of endorsement for co-financing and list of individuals/experts and their respective institutions consulted during the in-country consultation are appended as annexes in section 6.

II. GENERAL OVERVIEW

2.1. SITUATION ANALYSIS

13. The Federated States of Micronesia is a young, independent nation created from part of the former United States administered United Nations Trust Territory of the Pacific Islands following conclusion of a Compact of Free Association with its former administrator, the United States, in 1986. In 1991, the FSM became a member nation of the United Nations. The FSM includes the most geographically and culturally diverse part of the greater Micronesian region. The nation is comprised of four states – Yap, Chuuk (formerly Truk), Pohnpei (formerly Ponape), and Kosrae (formerly Kusraie) – lying along the equator and stretching about 1,700 miles (2,700 kilometers) in geographic sequence from west to east.

14. The population in 2006 (mid-year estimate) was estimated at 108,100 with 53,400 in Chuuk State, 34,900 in Pohnpei, 11,600 in Yap and 8,000 in Kosrae States. Each state has considerable autonomy within the federation, but their unity provides greater resources with which to face the challenges of development. The states have devised their own strategies for development, while an integrated perspective for the federation is provided by the national government. This overall national development vision is described in the most recent FSM National Development Strategy.



Figure 1: Location of Micronesia

15. The marine area within the FSM’s Exclusive Economic Zone (EEZ) totals over one million 2.6 million km² and includes abundant and varied resources. The total land area of 607 islands is approximately 701 km². A number of these islands are relatively large and mountainous or hilly, while the rest are small, flat coral atolls or raised coralline islands. The diverse habitats and species of the natural environment have always had a profound influence on the Micronesian people and their cultures.

There are marked differences among and even within the four states, reflecting both the conditions of nature and the social structures that have evolved over the thousands of years since the islands were first settled.

16. The islands of the FSM can be divided into two types: high volcanic islands comprising Pohnpei Island, Chuuk Lagoon Islands, and Kosrae Island, Yap Island which is sedimentary, and low coral atolls. Pohnpei, Chuuk and Kosrae are characterised by steep, rugged uplands, whereas Yap Island has more gently sloping uplands surrounded by substantial, often swampy lowlands. The islands were originally under natural forest cover, but the natural upland forests are disappearing rapidly being converted to agroforestry or secondary vegetation, to the extent that significant areas only remain on the islands of Pohnpei and Kosrae.

17. Micronesia's climate is typical of small tropical islands. The rainfall and humidity are usually high with distinctive wet and dry seasons on the leeward (north-western) sides of the main islands. Temperatures are high and generally uniform throughout the year. Micronesia experiences northeast trade winds almost all times of the year. However severe tropical cyclones occur during the summer months of December to February. Micronesia is also vulnerable to anomalously long dry spells that coincide with the El Nino South Oscillation (ENSO) phenomena. These vulnerabilities are particularly exacerbated during extreme events.

18. Observed trends and variability in climate derived from quality long term climate data from the region show that mean island near-surface air temperature increased by between 0.3-0.8 degrees Celsius during the 20th century, with the largest increase in the zones south west of the South Pacific Convergence Zone (SPCZ) (Salinger 2000). Maximum temperature increased by 0.67°C and minimum temperature by 0.18 °C (mean of 0.59 °C) while precipitation decreased by 49.28 mm.

19. Economic activity consists primarily of subsistence farming and fishing. The islands have few mineral deposits worth exploiting, except for high-grade phosphate. The potential for a tourist industry exists, but the remote location, a lack of adequate facilities, and limited air connections hinder development. The Amended Compact of Free Association with the US guarantees the Federated States of Micronesia (FSM) millions of dollars in annual aid through 2023, and establishes a Trust Fund into which the US and the FSM make annual contributions in order to provide annual payouts to the FSM in perpetuity after 2023. The country's medium-term economic outlook appears fragile due not only to the reduction in US assistance but also to the slow growth of the private sector. The estimated nominal GDP for the FSM was \$242.1 million with the largest contributing sectors being Productive Enterprises (\$85.5 million), Government (\$75.2 million), Households (\$57.7 million) and Financial Enterprises (\$5.2 million). The estimated nominal GDP per capita was \$2,189.

Ratification of the UNFCCC

20. Micronesia ratified the UN Framework Convention on Climate Change (UNFCCC) on 18 November 1993, and has submitted its Initial National Communication (INC) to the UNFCCC on 02 October 1997 and an addendum on 22 February 2000. Following the preparation of its INC and Phase II enabling activities, the country has initiated efforts to create an institutional set-up that seeks to mainstream climate change issues into the national legal frameworks. Moreover, its INC provides compelling evidence that, by global standards, Micronesia is one of the nations most vulnerable to climate change and sea-level rise.

21. Ratification of the UNFCCC is one step forward in terms of commitment to addressing climate change and related issues. Micronesia is also a Party to many other UN conventions, such as those, among others: biological diversity, biosafety, persistent organic pollutants, and combating desertification. The country has also ratified the Kyoto Protocol on 21 June 1999.

22. Micronesia has embarked on an economic growth policy which is focused on improving its economic performance, education, private sector development and creation of employment, agricultural opportunities, social structure, infrastructure and services, tourism and public sector efficiency. These key areas are outlined in the Strategic Development Plan 2003-2023 (SDP). It has also produced numerous policy documents as part of its contribution to the 2002 World Summit on Sustainable Development and the Johannesburg Plan of Implementation (JPOI), the ten-year review of the Barbados Programme of Action and the International Meeting (IM) in Mauritius as well as other regional meetings and conferences. Additionally, Micronesia has prepared other documents pertaining to its obligations under various multilateral environmental agreements (UNCCD, CBD, Montreal Protocol, Basel, Ramsar, etc).

SUSTAINABLE DEVELOPMENT STRATEGY

23. The Government of Micronesia (GoM) has adopted a Strategic Development Plan 2003-2023, a 20-year plan to pursue improvements in governance and strengthen institutions for delivery of government services. Following the 1999 FSM Second National Economic Summit, it was widely recognized that improvement of the nation's infrastructure is critical to the expansion of productive sector activities and the development of the private sector. Accordingly, the provision of efficient and cost-effective infrastructure was endorsed by the summit as one of the five guiding principles that should shape the FSM's strategy to promote private sector development. This IDP covers eight infrastructure sectors: electric power, water and wastewater systems, solid waste management, roads and pedestrian facilities, maritime transportation, air transportation, education and health.

2.2 STAKEHOLDER ANALYSIS

Process and approach used

24. The consultations on Pacific Adaptation to Climate Change (PACC) were conducted by the PDFB team¹ and involved seven stakeholder consultations, workshops and focus group meetings. Three approaches were used to solicit and collect information from various ministries, agencies, institutions of government and non-government organizations:

- a) Gathering of information (including policy documents) relating to the activities, programmes and projects from various government ministries, departments and agencies,
- b) Meetings/consultations and workshop held with representatives of relevant ministries, agencies institutions of government and non-government organizations.

25. The consultations were focused on the activities relating to adaptation and other related issues such as institutional arrangements, and opportunities for promoting synergy between the various activities and organizations, priorities for PACC activities, consistent with the UNDP and GEF guidelines/criteria for adaptation activities. Specific issues covered in the meetings and consultations included all elements of project implementation including policy/regulatory framework to integrate adaptation within the design

¹ Chief Technical Adviser, UNDP Programme Officer and GEF Expert Consultant

and implementation of development activities; institutional framework; information and knowledge; stakeholder involvement and co-financing possibilities.

Institutions and individuals involved/consulted

26. Two main government agencies; Department of Economic Affairs and the Kosrae State Environmental Protection Agency, involving five experts were consulted during the in-country consultations. These consultation meetings were focused on identifying adaptation activities that could be funded under the PACC project within the coastal zone management and associated infrastructure thematic area. Coastal zone management and its associated infrastructure was selected because of prior assessment that had been undertaken to climate proof the construction of the circumferential road in Kosrae under the ADB-funded Climate Adaptation in the Pacific (CLIMAP) project.

27. Given that thematic area for adaptation intervention was identified and selected already by the National Climate Change Country Team, the PACC team concentrated their efforts in identifying additional/adaptation activities within the coastal zone management and associated infrastructure together with the stakeholders. Adaptation activities are outlined in section III of this report.

Meetings with stakeholders

28. The PACC Consultation Team (PCT) paid a courtesy call on the Secretary of the Department of Economic Affairs to brief him on the purpose and objectives of the PACC project. Thus, briefing from the PACC Team emphasized the need to identify adaptation activities within the coastal zone management and associated infrastructure thematic area. The Secretary of DEA emphasized that the thematic area selected is consistent with the government's infrastructure development plan and endorsed the pilot site of Kosrae where the project would be located. It was agreed that further consultation meetings would focus on this theme with relevant state authorities. The consultations would ascertain the identification of possible adaptation activities, institutional arrangements, and possibilities for co-financing of project activities within coastal management and infrastructure.

29. Consultations were held with the head of the Kosrae Island Resources Management Authority (KIRMA) to identify activities that could be funded under the PACC pilot project on construction of a section of the circumferential road. The KIRMA indicated that the project would be located in the Tafunsak municipality which often has serious transport problems. The construction of the road would enable the people to transport their produce to markets and avail themselves for other social and economic services. He also stressed that this section of the road was the focus of an assessment study on climate proofing undertaken by the CLIMAP project. He agreed to provide information and data on the proposed pilot site with regard to socio-economic and biophysical features.

2.3 CLIMATE CHANGE PROGRAMMES, PROJECTS AND ACTIVITIES

30. A number of climate change programmes, projects and activities have been carried out in Micronesia since the entry into force of the UNFCCC. Micronesia was one of ten countries of the Pacific who participated in the Pacific Islands Climate change Assistance Programme (PICCAP) from 1997 to 2001. PICCAP was a multi-country regional enabling activity project funded by the GEF, implemented by UNDP and executed by SPREP to assist participating countries to prepare their initial communications under the UNFCCC. Micronesia prepared its initial national communication and submitted it to the UNFCCC on February 22, 2000.

31. The second major climate change programme implemented in Micronesia was part of a project titled Climate Adaptation in the Pacific (CLIMAP), an ADB-funded programme on climate proofing which was also implemented in the Cook Islands. This project enabled Micronesia to determine the climate risks associated with various development sectors including strengthening of their protective infrastructure (seawall) in the coastal zone as well as the construction of a circumferential road affected by sea-level rise and coastal erosion and flooding from storm surges.

Vulnerability and adaptation

32. About 70% of Micronesia's population and infrastructure are located in the coastal area. This is a serious concern because nearly all the coastal settlements in Micronesia are located in low-lying areas, hence are, very vulnerable to climate change and sea-level rise. The cyclones caused severe damage to agriculture and to bio-diversity. Micronesia is also very vulnerable to other extreme climate events, for example, prolonged drought periods associated with the ENSO events and coral bleaching stimulated by extremely low tides.

33. A 'no-regrets' approach to adaptation is necessary, despite high initial costs, to provide effective measures to mitigate adverse impacts caused by climate change and sea-level rise. Although, Micronesia's vulnerability will increase with future global climate change, it is imperative to develop a national policy framework to raise awareness about the need for adaptation and mitigation actions. The initial national communication of Micronesia highlighted the following:

34. Most of the economic activities, infrastructure and human settlement are located in the coastal areas. These activities have had adverse impacts on the coastal environment, particularly the lagoons, coral reefs, mangrove forests and the shoreline. A range of sectoral adaptation measures has been assessed, based on economic and the environmental cost, cultural suitability and practicability in the initial national communication. Some of these are quite pertinent for adaptation in the coastal zones including the development of a suitable integrated coastal zone management plan.

III. SECTORAL ANALYSIS

35. The principal objective of Pacific Adaptation to Climate Change (PACC) is to facilitate the implementation of long-term adaptation measures to increase the resilience of a number of key development sectors in the Pacific island countries to the adverse impacts of climate change. The development sectors are food production and food security, water resources management and coastal zone management and its associated infrastructure. Given limited financial resources the countries have been encouraged to focus only one of the three development sectors where adaptation intervention would be essential. The in-country consultations would also determine detailed adaptation activities and baselines in each country.

3.1 METHODOLOGY/CRITERIA FOR SELECTION OF PRIORITY SECTOR

36. Given that PACC would only support adaptation activities in one of the three main development sectors of food production and food security, water resources management and coastal zone management and associated infrastructure it was necessary to select one of these priority areas for adaptation intervention. In order to facilitate the selection of the priority area the following criteria was used for PACC priority sector. That the selected adaptation project or activities should have:

- a) A strong fit/alignment with the Micronesia Government's existing programmes

- b) All necessary baseline assessments have been carried out, and additional activities are ready for implementation, and,
- c) Ability to co-finance and ability to deliver.

37. The selection of the PACC pilot project in FSM was made easier because a prior assessment carried out under an ADB-funded Technical Assistance Programme on Climate Adaptation in the Pacific Islands (CLIMAP) had already identified a possible project and the project site. The project was intended to mainstream adaptation through integrated risk reduction into program and project operations of the ADB to better respond to country needs; and (ii) to mainstream adaptation on a pilot basis in two ADB member countries, i.e. the Cook Islands and the Federated States of Micronesia (FSM).

38. In FSM the project focused on “*climate proofing*²” of the FSM National Strategic Development Plan (infrastructure, human health and environment components), a roading infrastructure project in Kosrae and a coastal community in Pohnpei. Based on these case studies, the FSM National Climate Change Country Team (NCCCT) had decided that PACC project would focus on the roading project in Kosrae since the design of the road had been climate proofed already by the CLIMAP project. This information was also made available to the PCT during initial consultation meeting. Hence, the focus of discussions that followed was centered on the implementation arrangements and possibilities for co-financing.

Thematic area for adaptation

39. At the meeting with the officials of the Department of Economic Affairs (including Secretary and Deputy Secretary) and the Director of the Kosrae Island Resources Management Authority (KIRMA) it was agreed that PACC project in FSM would focus on implementation of adaptation activities on a coastal roading infrastructure through project entitled “*Piloting climate change adaptation in road infrastructure in the coastal zone in Kosrae, Micronesia.*” This project would focus on climate proofing the construction of the circumferential road of Kosrae State. Climate proofing of the design and construction of a section of the road will include enhancing and where necessary, developing protective measures (hard and soft solutions) in the municipality of Tafunsak, Kosrae. The construction of the circumferential road is necessary to increase the resilience of the socio-economic infrastructure and activities thereby enhancing the adaptive capacity of coastal communities to impacts of climate change and sea level rise in the long term.

3.2 ASSESSMENT OF PRIORITY SECTOR FOR ADAPTATION ACTIVITIES

40. The infrastructure development plan for Kosrae includes completion of the circumferential road, closing what is a 16-kilometer (km) gap. Funds for the road project are to be provided under the Compact of Free Association with the United States of America. Construction of at least 10.6 km of the road’s northern portion was scheduled for 2004. The primary purpose of this development is to complete the road around the island of Kosrae and provide all weather land access to the remote village of Walung (population 230) in the southwest. It is the only community without reliable links to the island’s other municipalities. Completion of this link will also allow easier access to the presently undeveloped interior of the island along the western coast, providing scope for agriculture and new settlement in the area.

² *Climate Proofing – A Risk-based Approach to Adaptation* is shorthand for reducing, to acceptable levels, the risks due to climate variability and change, including extreme events.

41. Construction of the road to join Walung village will benefit the whole island as it will improve access into and out of Tafunsak. Part of the planned route will have to traverse or circumnavigate a large freshwater swamp, which is dominated by a tree locally called *ka* (*Terminalia carolinensis*). The swamp, the largest remaining stand of *T. carolinensis* in the world, is officially designated as an Area of Biological Significance.

42. The drainage works for the original road design (both built and as-yet-unbuilt sections) were based on a maximum hourly rainfall of 178 millimeters, which supposedly had a return period of 25 years. An analysis of more reliable data indicated that an hourly rainfall with a return period of 25 years is 190 mm. By 2050, however, the hourly rainfall with a 25-year return period will have increased to 254 mm as a consequence of climate change.

43. A recommendation that the design of the road be modified so the drainage works could accommodate an hourly rainfall of 254 mm was accepted by the state government of Kosrae and a climate-proofed design was prepared and costed by state employees. The incremental cost of climate proofing the road design and construction for the as-yet-unbuilt section is in the vicinity of \$511,000. While the capital cost of the climate-proofed road would be higher than if the road were constructed to the original design, the accumulated costs, including repairs and maintenance, would be lower after only about 15 years. This is because repair and maintenance costs would be lower for the climate-proofed road. The internal rate of return was found to be 11%. A 3.2-km portion of the road section has already been constructed, including the drainage works. The design for these was also based on an hourly rainfall of 178 mm for a 25-year recurrence interval.

44. Analyses show that it is more costly to “climate proof” retroactively - US\$776,184 for a 3.2 km section of existing road (US\$243,000 per km) as opposed to US\$511,00 to “climate proof” 6.6 km of new road (US\$77,00 per km). But a cost benefit analysis revealed that the retroactive *climate proofing* is still a cost effective investment, with an internal rate of return of 13%. Based on the information available, the Government of the State of Kosrae has decided it will not proceed with construction of the northern section of the new road until additional funds are available to complete the *climate proofing*.

45. Based on the information available to it, the Kosrae state government has decided it will not proceed with construction of even the northern section of the new road until additional funds are available to complete the climate proofing. The PACC project will facilitate the climate proofing the construction of the northern section of the new road. This would also ensure the continued protection of the valued ecosystems, including the Area of Biological Significance. Prior to commencing construction, all the environmental and other approvals required by the state of Kosrae would, of course, have to be in place.

3.3 CURRENT INSTITUTIONAL AND DEVELOPMENT BASELINE IN PRIORITY SECTOR

46. As with many small islands developing States, Micronesia is concerned about the impacts of future climate change and sea level rise given the exposure of main socio-economic and cultural activities and infrastructure being located on or near the coastline. Given the high priority placed on the coastal infrastructure, socio-economic, cultural activities and communities, the GOM has prepared an Infrastructure Development Plan (IDP) in consultation with the States of Chuuk, Kosrae, Pohnpei and Yap and under the guidance of the FSM National IDP Steering Committee. The Plan assesses the current state of infrastructure in nine sectors: electrical power, water/wastewater, solid waste management, roads

and pedestrian facilities, maritime transportation, air transportation, education, health and government buildings and develops a program and budget over the period FY2004-FY2023 to respond to the needs.

47. Based on an estimated average funding availability for infrastructure from all sources of \$35 million, a total investment of \$748 million has been envisaged over the 20-year IDP period in the nine infrastructure sectors. The program takes into account each of the State Government five-year infrastructure proposals covering the period FY2004-FY2008. The cost for Program Management includes funding for the Program Management Unit (PMU), the planning studies required to conduct detailed project feasibility analysis, and support for some institutional strengthening requirements in the transportation, education and health sectors. This represents an average allocation for infrastructure from Compact funds of \$18.6 million per annum and \$18.0 million from other sources.

3.4 IMPACTS OF CLIMATE CHANGE ON THE PRIORITY SECTOR

48. During an El Niño event the Federated States of Micronesia suffers drought conditions during the winter and spring months. With a severe El Niño episode, drought can begin as early as late autumn and extend into the following summer. The stronger the El Niño, the longer-lasting the drought conditions will likely be. Whether an El Niño event is “typical” or stronger than usual, Yap and western Chuuk, being in the western part of the Federated States of Micronesia, tend to be affected somewhat earlier and, in most cases, more harshly than eastern Chuuk and the eastern states of Pohnpei and Kosrae.

49. The western region of the Federated States of Micronesia is subject to the occasional (one in 20 years return period) tropical cyclone (typhoon). These can cause severe damage. A typhoon that struck Pohnpei on April 24, 1997 caused many landslides, damage to vegetation as well as infrastructure, and 19 deaths. When El Niño conditions prevail, typhoons tend to form farther to the east and northeast than normal. The typical directions of the storm tracks taken by these typhoons are to the north, northwest, or west. During an El Niño event the Federated States of Micronesia is most vulnerable to typhoon activity during November and December, when typhoons have the greatest likelihood of forming directly east, and then tracking west, gathering strength before travelling across the Federated States of Micronesia.

50. The likelihood (i.e. probability) components of climate-related risks in Pohnpei and Kosrae are evaluated, for both present day and future conditions. Changes into the future reflect the influence of global warming. The risks evaluated in this way are extreme rainfall events (both hourly and daily), high sea levels, strong winds, extreme high air temperatures and drought. Low rainfall months (below the five percentile, which is often used as an indicator of drought) are concentrated in the latter part of the period of observation, indicating that the frequency of drought has increased markedly since the 1950s. The years with a high number of months below the five percentile coincide with El Niño events. A similar analysis of projected daily rainfall amounts for Pohnpei reveals that the frequency of low rainfall months will generally remain at these higher levels for the 21st century. This would be the same for Kosrae.

3.5 METHOD FOR ASSESSING PRIORITY SECTOR BASELINE

51. The assessment of the coastal zone management and associated infrastructure including climate proofing of a section of the circumferential road in Kosrae Island was carried out under a CLIMAP project. CLIMAP was designed to assist Pacific developing member countries of the Asian Development Bank (ADB) to adapt to current and future climate risks have been prepared through the use of Climate Change Adaptation through Integrated Risk Reduction (CCAIRR) framework and methodology to demonstrate a risk-based approach to adaptation, and to mainstreaming adaptation. FSM was one of two

countries selected to show how to mainstream this risk-based approach at three levels: national development planning, sector programs and project activities.

52. Implementation of specific risk-reduction measures at project and local levels can be facilitated if land-use planning and associated regulations and permitting procedures for structure, infrastructure and community development projects incorporate requirements that are designed to reduce risks related to current and future climate extremes and variations. This strengthening of planning and regulatory provisions is, in turn, assisted by ensuring that national policy frameworks and strategies address the potential for climate-related risk events to have large adverse social, environmental and social consequences.

IV. MECHANISM FOR DELIVERY OF FULL-SIZE PROJECT

4.1 INSTITUTIONAL ARRANGEMENTS

53. All climate change programmes, projects and activities are being coordinated by the Department of Economic Affairs (DEA). Climate Change issues are dealt with by two full-time staff that carry out tasks/activities relating to climate change in the country such as the preparation of climate change enabling activities (e.g. second national communication). The DEA also serves as a secretariat for the National Sustainable Development Council (NSDC) which provides oversight and guidance on the implementation of activities relating to climate change.

54. Under the PACC-Micronesia project, the DEA will continue to coordinate climate change activities relating to PACC. However, given that PACC is focused on implementation of adaptation activities in the State of Kosrae, the implementing agency for PACC-MICRONESIA will be the State of Kosrae Integrated Resource Management Agency (KIRMA). KIRMA will also serve as secretariat to the NSDC on issues relating to the implementation of PACC-MICRONESIA.

55. In addition to the implementation of PACC-MICRONESIA, KIRMA will host at least two full-time staff that will provide the day-to-day operation of the PACC. These two full-time staff will be part of the PACC Project Management Unit (PMU) who will be directly responsible to the Chief Executive Officer of KIRMA.

56. At the national level, PACC-MICRONESIA will be implemented by various stakeholders within their respective mandates while scientific, technical and policy oversight will be provided by the NSDC comprising representatives from various government ministries, agencies and institutions and the private sector.

4.2 ASSESSMENT OF EXISTING AND POTENTIAL BARRIERS TO ADAPTATION IMPLEMENTATION

57. PACC-MICRONESIA is underpinned by GOM policy and regulatory framework and its Strategic Development Plan 2003-2023 wherein it identifies “development of roads and pedestrian facilities” as a critical component of its current development strategy. A number of climate change enabling activities (e.g. national communication, CLIMAP) have also involved numerous organizations, institutions and individuals in carrying out various tasks and activities. These activities have been supported by the NSDC through the provision of scientific, technical and policy oversight and guidance. Thus many of the roles and responsibilities have been clarified. However some barriers still remain and will have to be

overcome in order to improve delivery of the PACC-MICRONESIA. Some of these barriers include, competing demands on staff time, inadequate staff resources, equipment, and lack of incentives.

58. Lack of capacity (human, systemic, institutional, financial and technical) constrains the sharing of information and knowledge particularly of climate change and adaptation issues which makes the integration of climate change adaptation into sustainable development prohibitive. A project of this kind will more than likely make the integration of climate change into sectoral planning possible.

V. EXPECTED GOAL, OUTCOMES, OUTPUTS AND ACTIVITIES

59. The main goal of this project is to “increase the resilience and enhance adaptive capacity of coastal communities, socio-economic activities and infrastructure. This goal will be achieved through a project “Piloting climate change adaptation in coastal communities of Micronesia focusing on integrated coastal zone management and its associated infrastructure. This project will also focus on enhancing, and where necessary, constructing coastal protective infrastructure.

60. The implementation of integrated coastal zone management (ICZM) will entail the implementation of sustainable projects that will create coastal sanctuaries and ecological parks that will act as buffers to extreme climate-related events, protect the environment and promote sustainable coastal development. Adaptation interventions will include (soft) non-structural and structural (hard) options that compliment each other. The listed activities below indicate community efforts to improve communities’ resilience to natural hazards and for conservation and protection from further degradation.

61. The goal of PACC-MICRONESIA is to increase the resilience of coastal communities/villages to the impacts of climate change through integrated coastal zone management in communities/villages (objective) which will increase resilience and adaptive capacity of the coastal communities/villages, socio-economic activities and infrastructure to impacts of climate change. Activities could include improving and rehabilitating coastal land, construction of coastal/flood protection systems, gravelling and upgrading/construction of seawall/access roads and regeneration and restoration of mangrove areas.

Goal: To enhance the capacity of the FSM adapt to climate change, including variability, in selected key development sectors.

Objective:

The main objective of this project is to “increase the resilience and enhance adaptive capacity of coastal communities, socio-economic activities and infrastructure. This objective will be achieved through a project “Piloting climate change adaptation or climate proofing of the construction of a section of a circumferential road in Tafunsak, Kosrae Island.

Specific Outputs

Output 1.1: Relevant plans and programmes incorporate climate risks in the coastal sector in the FSM.

Output 2.1: Guidelines to integrate coastal climate risk management into relevant plans and programmes.

Output 2.2: Trained staff in key agencies to respond to impacts of storm surges and rises in sea surface temperatures on coastal food production systems.

Description:

Output 1.1: Relevant plans and programmes incorporate climate risks in the coastal sector in the FSM.

This will include integrating climate change into key development sectors that are highly vulnerable to climate change which include; agriculture, water, and coastal management. At the national level, work in climate variability and change is still the 'domain' of Meteorology Services, Environment Departments and National Disaster Agencies but the impacts are being felt by other agencies e.g. Fisheries, Agriculture, Forestry, Physical Planning, and Public Works. To mainstream key climate change issues into development plans of government sectors, a number of critical steps would be followed, which requires collaborative analytical and policy inputs from a number of different technical experts and domestic partners. Critical components of mainstreaming include: review of the NSDS and its role in national development; the identification of the strengths, weaknesses, gaps, responses to strengthen specific sectoral management (problem tree analysis and objective/ solution identification); the review of the link between sectoral plans and NSDS and the relationship between sectoral medium term budget and the medium term national fiscal expenditure and revenue budget; and strengthening of sector level budgeting that reflects outcome focused priorities and national development goals.

Specific activities to be undertaken would include:

- Promote and support dialogue, exchange of information and coordination amongst early warning, disaster risk reduction, disaster response, development and other relevant agencies and institutions at all levels, with the aim of fostering a holistic and multi-hazard approach towards disaster risk reduction.
- Development or customizing of a mainstreaming methodology that takes into consideration climate change technical and policy frameworks and issues;
- Forming of a Mainstreaming Team to work with key government sectors to mainstream climate change issues into key sectoral plans and policies;
- Countries to form V&A Teams comprising people in various agencies and institutions who can collaborate, integrate their work and be the main contact points in the various agencies to champion adaptation approaches and initiatives. Once the teams are formed a range of capacity building initiatives to be developed in the next component can be implemented.
- Mainstream climate change risk considerations into planning procedures, especially for major infrastructure projects, including the criteria for design, approval and implementation of such projects and considerations based on social, economic and environmental impact assessments.

Objective:

Objective 1: Integrate climate change adaptation (climate proofing) into construction of a road.

Specific Outputs:

Output 1.1: Guidelines to integrate climate risks (e.g. intense rainfall and storm surges) into coastal road designs.

Output 1.2 Staff trained in key agencies to adapt coastal road designs to the impacts of climate change (with co-financing support).

This output would enable the state of Kosrae to build its capacity to develop and demonstrate adaptive designs in coastal road systems to enhance resilience against intense rainfall and storm surges. Climate change, which manifests as intense rainfall and storm surges incur a cost to building and maintenance of existing and new roading networks. Climate proofing new road designs would go along way in reducing maintenance costs over time. In terms of baseline activity, the drainage works for the original road design (both built and as yet un-built sections) were based on a maximum hourly rainfall of 178 millimeters, which supposedly had a return period of 25 years. Assessments carried out on the site indicate that an hourly rainfall with a return period of 25 years is 190 mm.³ By 2050, the hourly rainfall with a 25-year return period will have increased to 254 mm as a consequence of climate change. The recommendation therefore is for the design of the road to be modified so that the drainage works could accommodate an hourly rainfall of 254 mm. While the capital cost of the climate-proofed road would be higher than if the road were constructed to the original design, the accumulated costs, including repairs and maintenance, would be lower after only about 15 years. The state of Kosrae under its infrastructure development plan would be making available USD 6.9 million for the development of this circumferential road, closing the current 16-kilometer (km) gap. Activities specific to developing capacity to improve roading design of the Kosrae circular road to withstand an hourly rainfall rate of 254mm includes:

- Evaluate engineering designs and plans of the current Kosrae circular road taking climate change issues into consideration;
- Develop a guide on incorporating climate change concerns into infrastructure designs drawn from experiences in carrying out the above activity;
- Develop better integrated coastal management designs that include mangrove protection and/or replanting;
- Establishment of buffer/set back zones;
- Participatory selection of tree species and demonstration of planting methods to stabilize road shoulders;
- Capacity development for design and construction of coastal protective structures with design specifications for a 25-year storm/flood event;
- Documentation and dissemination of approach taken, methodology used and technology applied.

³ ADB Report 2005

PROJECT LOG FRAMES AND INDICATORS

Project Log Frame and indicators for FSM would be finalized during the inception meeting of the PACC project.

BUDGET

Responsible	ERP/Atlas	Budget Description								
	Budget Code									
				Year 1/08	Year 2/09	Year 3/10	Year 4/11	Year 5/12	Total Budget	
Outcome 1	71200	International Consultants (including national regional staffing)	10,000	10,000	0	0	0	0	10,000	
	71300	Local Consultants (including national staffing)	30,000	5,000	5000	10,000	5,000	5,000	30,000	
	71400	Contractual Services - Ind	20,000	5,000	5,000	5,000	5,000	0	20,000	
	71600	Travel	20,000	0	5,000	5,000	5,000	5,000	20,000	
	72100	Contractual Services - Co	40,000	10,000	10,000	10,000	10,000	0	40,000	
	72200	Equipment & Furniture	10,000	5,000	1,000	3,000	1,000	0	10,000	
	72400	Communication & Audio Visual equipment	4,000	2,000	500	500	500	500	4,000	
	72500	Supplies	1,000	500	100	100	200	100	1,000	
	72800	Information technology and Outreach	3,000	500	1,000	500	1,000	0	3,000	
	74200	Printing, Publishing & Production	2,000	0	500	500	500	500	2,000	
Subtotal			140,000	38,000	28,100	34,600	28,200	11,100	140,000	
Outcome 2										
	72100	Service contract								
	71200	International Consultation	10,000	10,000	0	0	0	0	10,000	
	71300	Local Consultants	80,000	10,000	30,000	20,000	10,000	10,000	80,000	
	71400	Service Contracts - Ind	200,000	30,000	70,000	70,000	20,000	10,000	200,000	
	71600	Travel	20,000	2,000	5,000	5,000	5,000	3,000	20,000	
	72100	Contractual services - Co	420,000	55,000	205,000	55,000	55,000	50,000	420,000	
	72200	Equipment & Furniture	10,000	0	5,000	5,000	0	0	10,000	
	72500	Supplies	80,000	10,000	25,000	25,000	10,000	10,000	80,000	
	72400	Audio Visual Equipment and Communication	20,000	5,000	5,000	5,000	2,500	2,500	20,000	
	72800	Information Technology Equipment and Outreach	15,000	5,000	4,000	3,000	2,000	1,000	15,000	
	74200	Printing and Publications	15000	5,000	4,000	3,000	2,000	1,000	15,000	
Subtotal			870,000	132,000	353,000	191,000	106,500	87,500	870,000	
Outcome 3										
	71200	International Consultants								
	71300	Local Consultants							0	
	71600	Travel	20,000	4000	4000	4000	4000	4000	20,000	
	72100	Contractual Services - Co							0	

DRAFT 07 November 2006

Subtotal		20,000	4000	4000	4000	4000	4000	20,000
Outcome 4		88,758	17752	17752	17752	17752	17750	88,758
Subtotal		88,758	17752	17752	17752	17752	17750	88,758
Total		1,118,758	191,752	402,852	247,352	156,452	120,350	1,118,758

REFERENCES

- ADB, 2005. Climate Proofing: A Risk-based Approach to Adaptation, Manila, Philippines.
- ADB (Asian Development Bank) 2004: *Environmental Pacific Regional Strategy, 2005-2009*, ADB Manila, Philippines, 105 pp.
- Adger, N., Mace, M.J., Paavola, J., and Razzaque, J., 2003: Justice and equity in adaptation. *Tiempo* 52, 19-22.
- Adger, W. N., S. Huq, K. Brown, D. Conway, M. Hulme, 2003: Adaptation to climate change in the developing world. *Progress in Development Studies*, 3 (3), 179-195.
- Barnett, J., 2001: Adapting to climate change in Pacific Island Countries: The problem of uncertainty. *World Development*, 29, 977-993
- Brazdil, R., T. Carter, B. Garaganga, A. Henderson-Sellers, P. Jones, T. Carl, T. Knustson, R.K. Kolli, M. Manton, L.J. Mata, L. Mearns, G. Meehl, N. Nicholls, L. Pericchi, T. Peterson, C. Price, C. Senior, Q.C. Zeng, and F. Zwiers, 2002: *IPCC Workshop on changes in extreme weather and climate events*, Workshop Report, Beijing, China, 11-13 July, 2002, 41- 42. Accessed 15.11.2004 at <http://www.ipcc.ch/pub/extremes.pdf>
- Folland, C.K., J.A. Renwick, M.J. Salinger, N. Jiang, and N.A. Rayner, 2003: Trends and variations in South Pacific Islands and ocean surface temperatures. *Journal of Climate.*, 16, 2859-2874
- Folland, C.K., J.A. Renwick, M.J. Salinger, and A.B. Mullan, 2002: Relative influences of the Interdecadal Pacific Oscillation and ENSO on the South Pacific Convergence Zone. *Geophysical Research Letters*, 29, 21-1-21-4
- Government of FSM, 1997. Climate Change National Communication 199, FSM Climate Change Program, Palikir, Pohnpei, FSM.
- Government of FSM, 1999. Initial National Communication under the UNFCCC, and addendum, Palikir, Pohnpei, FSM.
- Government of FSM, 2003. 3rd FSM Economic Summit: Outcomes of the Summit Special Committee on the Infrastructure Development Plan, Palikir, Pohnpei, FSM.
- Government of FSM, 2003, Strategic Development Plan: 2004-2023. Vol. III. Infrastructure Development, Palikir, Pohnpei, FSM.
- Griffiths, G.M., M.J. Salinger, and I. Leleu, 2003: Trends in extreme daily rainfall across the south pacific and relationship to the South Pacific convergence zone. *J. Climatol.*, 23, 847-869.
- IPCC, 2001: *Climate Change 2001: The Scientific Basis*. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change, J.T. Houghton, Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson (eds.), Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 881 pp.
- KIRMA, 2005. Kosrae Biodiversity Strategy and Action Plan, KIRMA, Kosrae.
- Lal, M., 2004: Climate change and small island developing countries of the South Pacific, *Fijian Studies, Special Issue on Sustainable Development*, V2(1), 15-31.
- Manton, M.J., P.M. Dellaa-Marta, M.R. Haylock, K.J. Hennessy, N. Nicholls, L.E. Chambers, D.A. Collins, G. Daw, A. Finet, D. Gunawan, K. Inape, H. Isobe, T.S. Kestin, P. Lefale, C.H. Leyu, T. Lwin, L. Maitrepierre, N. Oprasitwong, C.M. Page, J. Pahalad, N. Plummer, M.J. Salinger, R. Suppiah, V.L. Tran, B. Trewin, I. Tibig, and D. Yee, 2001: Trends in extreme daily rainfall and temperature in southeast Asia and the south Pacific: 1961-1998. *J. Climatol.*, 21, 269-284.
- Nurse, L., G. Sem, J.E. Hay, A.G. Suarez, P.P. Wong, L. Briguglio and S. Ragoonaden, 2001: Small island states. . In: *Climate Change 2001: Impacts, Adaptation, and Vulnerability*. J.J. McCarthy, O.F. Canziani, N.A. Leary, D.J. Dokken, and K.S. White (eds.). Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change,

- Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 842-975.
- Nurse, L., and R. Moore, 2005: Adaptation to global climate change: an urgent requirement for Small Island Developing States. *Review of European Community and International Law (RECIEL)*, 14 (2), 100-107.
- Wayne Law, 2006, *Plants and people of Micronesia*, New York Botanical Garden, New York, USA.
- World Bank, 2000: *Cities, Seas and Storms: Managing Change in Pacific Island Economies. Vol. IV, Adapting to Climate Change*. World Bank, Washington, D.C. 72 pp.
- World Bank, 2002: *Cities, Seas and Storms: Managing Change in Pacific Island Economies*. World Bank, Washington, D.C.
- World Bank, 2006: *Not If, But When: Adapting to Natural Hazards in the Pacific islands Region: A Policy Note*. World Bank, Washington, D.C., USA, 60 pp.

ANNEX

Letter of co-financing (to be attached)