



**PACIFIC ADAPTATION TO CLIMATE CHANGE**  
**PAPUA NEW GUINEA**

**REPORT OF IN-COUNTRY CONSULTATIONS**

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## 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 Papua New Guinea (Long 6 00 S, 147 00 E) are 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.*, 2001). 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 Niño, with extreme rainfall trends generally less spatially coherent than were those of extreme temperature (Manton *et al.*, 2001; Griffiths *et al.*, 2003). 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).

5. Climate change will be a major impediment to the achievement of sustainable development in small islands, as all economic and social sectors are likely to be adversely affected, and the cost of adaptation will be disproportionately high, relative to GDP. In attempting to mainstream adaptation strategies into their sustainable development agendas, small islands will be confronted by many challenges including insufficient resources, equity considerations, prioritization of adaptation measures and uncertainties over climate change projections and adaptation strategies.

6. 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.

7. 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.

8. Thus an adaptation strategy for the Pacific islands and indeed for Papua New Guinea 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 Objective of Pacific Adaptation to Climate Change (PACC)**

9. 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. Papua New Guinea, 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.

10. 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**

11. As one 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 Papua New Guinea in-country consultations on PACC which were held in Port Moresby, Papua New Guinea from October 16 to 20, 2006. The report is divided into five sections: section 1 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 the Papua New Guinea 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 Papua New Guinea 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

12. Papua New Guinea occupies the eastern half of the island of New Guinea; sharing a border with the Indonesian province of West Papua (formerly Irian Jaya) to the west, Australia to the south, the Solomon Islands to the east and the Federated States of Micronesia to the north (Figure 1).



Figure 1: Location of Papua New Guinea

13. It has four large islands (Manus, New Ireland, New Britain and Bougainville) and some 600 smaller islands including numerous inhabited coral atoll islands. It is a country rich in natural resources with gold, copper, agricultural products, and recently oil and natural gas. It is also a country of considerable biodiversity, which is estimated to comprise between 5-7% of the global biodiversity and also regional variations on most cultural, geographical and developmental dimensions. However, as a small economy, sustainable development is heavily influenced by local, provincial, national and international agendas.

14. The mainland of PNG has one of the most rugged terrains in the world with a central mountain range highly dissected, with the highest peak rising to 4,510 m (Mt. Wilhelm) and smaller islands include high volcanic mountains and low lying coral atolls. Types of environments range from mountain glaciers to humid tropical rainforests, swampy wetlands to pristine coral reefs. Much of the terrain is characterized by steep gradients, fast flowing rivers, swamps, with some parts of the country subject to active volcanic activities, landslides and tidal waves.

15. The total land area is 465,000 km<sup>2</sup> and the exclusive economic zone is 2.4 million km<sup>2</sup>. The country's Exclusive Economic Zone encompasses 17,000 kilometers of coastline and almost 2000 coastal villages, with a rural population of nearly 500,000 people. Communities in PNG have developed more than 800 languages as well as unique customs and traditions, in part due to isolation resulting from the country's rugged terrain.

16. Ninety seven percent of the country's total land area is held by customary landowners, giving them considerable and unique rights governing extraction of resources and compensation claims. Only about 0.1% of the land area is classified as arable and 84% is forested, although much of this is inaccessible. Given the difficult terrain, the diverse cultural heritage, including a complex customary system of land tenure, the several tiers of government and the shortage of skilled manpower, environmental and climate change management is highly complex.

17. The prevailing southeast trade winds during the months June to October act as a medium for dry air movement responsible for dry conditions over this period. The influence of these southeast trade winds gradually fades towards the equator where deep tropical weather dominates. Over the remaining months from December – April, which correspond to the southern summer, the major influences are the northwest monsoons originating in Asia. This airflow transports moist humid air and provides abundant moisture over the whole country, thereby enhancing precipitation over this period. Coupled with the warm sea surfaces of the Southern Hemisphere during the period and other factors, this is also the cyclone season. In between the two seasons are months where the wind regimes are less dominant. These are referred to as transitional months, such as the month of May immediately after the North West monsoon season and the months of October and November just preceding the North West monsoon season or just after the south east season.

18. The climate is characterized by high rainfall and humidity and high temperatures which remain generally uniform throughout the year. However, the country experiences severe tropical cyclones during the summer months of December to February, and is also vulnerable to anomalously long dry spells associated with warm phase of the El Nino-Southern Oscillation (ENSO) phenomenon. The country is also highly vulnerable to other extreme climate events including, for example, coral bleaching associated with high ocean surface temperatures and/or extremely high and low tides. The impacts of climate-related events are felt right across the nation's economic, social and environmental systems, thus making future changes in climate, including extreme events, an issue of great concern nationally.

19. In general, the rate of mean near surface temperatures warming have been relatively slower over the southern areas relative to higher latitude regions (difference of 0.25°C) since the mid 1970s compared to the tropical region (0.45°C) as represented by the Momote trend in Manus Province. Overall observed near surface temperature trend (0.50°C) resembles both the global and tropical Asian trend, with an overall error of +/- 0.15°C.

20. The conclusions reached seemed to be related to the prevailing phase in overall rainfall pattern. A further 25 years on, it seems that there has actually been an increase in the variability. Nevertheless, the previous assertion on the remarkably reliable nature of PNG's

rainfall still holds. Furthermore, it may be that the wet season rainfall could be increasing was reasonable, although the increasing phase has since ended in the mid 1980s. From current trends it may be inferred that the country is entering another increasing phase of wet season rainfall over the Port Moresby Region.

21. Much of the variability in precipitation patterns in the country correlates very well with the ENSO phenomenon. Similar correlations are obvious with the short-term variations in sea level. In particular, the warming and cooling phases, which are associated with anomalous decreases and increases in sea level, respectively. Observations of variations in the positive phase of dry seasonal rainfall trends showing weaker and fewer La Niña episodes infer reduced ENSO inputs into the sea level rise in PNG

22. By far the most important mechanism of climate and sea level variability in Papua New Guinea is related to the ENSO phenomenon. Effects of the southern oscillation of both mean sea level pressure and the sea surface temperatures show a definite correlation between the Southern Oscillation Index (SOI) and the rainfall patterns of the southern Papuan coasts in particular. The correlation gradually fades towards the equator with equatorial regions precipitation patterns showing marked relationships only during the stronger phases of ENSO.

23. Drought and frosts are generally common occurrence in the highlands of PNG and have significant impact on the economic and environment sectors. The influence of ENSO in catalysing the development of frost and droughts in the country is quite evident as shown by the 1997/98 prolonged drought. PNG lies just outside of the main Tropical Cyclone belt within the Southwest Pacific region. On average, tropical cyclones hit the country at the rate of about one cyclone per year. Despite PNG being a relatively free area from the cyclogenesis compared to other neighboring areas in the region, there is a far higher probability of tropical cyclones forming outside and tracking into the country.

24. The population of PNG was estimated to be approximately 5.7 million in 2004 with an annual growth rate of 2.3 percent. Similar to many developing countries, PNG has a high fertility level with 40% of the population under the age of 15, thus making it one of the youngest.

25. Agriculture is the mainstay of the PNG economy, accounting for approximately 30% of GDP and around 13% of total export earnings. Land currently set aside for food and cash crop production in the country accounts for about 30% of the country's total land area. Land suitability for tree crops, arable agriculture, pasture and irrigated rice is shown in Land currently in the food production cycle which amounts to 30,000 km<sup>2</sup> or 6.6% of total land area. Cash crops such as copra, coffee, cocoa, rubber and oil palm, as well as subsistence agriculture, based on root crops, sustain about 85% of the population. Surplus production is sold mainly in local markets, but also in distant, domestic markets. Large amounts of vegetables and fruits are produced in the Highlands, but inadequate transport and marketing infrastructure limit the supply to high populated urban centers. Also, these crops are highly perishable and suffer from variable product quality, resulting in high post harvest losses.

26. Almost 97% of land in PNG is customary land, owned either by individuals or under some form of clan ownership. Unfortunately, traditional landowners with short-term cash needs and desire for development through the sale of timber have often outweighed the long

term needs for conserving their resources for future generations. Some six million hectares are used in the rotational gardening cycle. The practice of bush fallow cultivation leads to very complex patterns of gardens and vegetation regrowth. Commonly, five to fifteen years of fallow will elapse before the regrowth is cleared for further food production.

27. Forest reserves cover over 36 million hectares or approximately 70% of the country's total land area. The sustainable harvest volume of available natural forest has been estimated at 3 million cubic metres per annum, assuming a 40-year cutting cycle. Commercial logging for exports is fairly widespread throughout all regions. Approximately 15 million hectares of the forests are accessible with one million hectares already logged. From 2000 onwards, the volume of log exports is forecast to be around 1.8 to 2 million cubic metres.

28. The fisheries resources of PNG are made up of a wide variety of lagoons, reefs, deep slopes, pelagics, and bottom species. Formal employment in the fisheries sector amounts to 1000 people. However, until 1997 when it was made mandatory to complete log books, the vast bulk, both by volume and value, of fish caught in PNG waters were not landed in the country, or recorded as export, while those who catch them are not taxed on the profits they make.

29. Coral reefs in Papua New Guinea cover a total area of 40,000 km<sup>2</sup>. For the most part, the coral reefs are relatively unaffected by human activities, but this largely reflects the country's dispersed and relatively isolated population as well as a lack of material development. Important anthropogenic threats to PNG reefs are considered to be unsustainable fishing, including both overexploitation and destructive practices; sediment mobilization as a result of deforestation from forestry, agriculture, and other activities, as well as population increase and urbanization.

30. The estuarine and coastal environments are endowed with dugong, whales, dolphins, birds, turtles, crocodile, fish and many invertebrate species such as molluscs, chinoderms and crustaceans. To date, about 300 species of coral and well over 3,000 species of marine fishes, have been identified. The species richness of sea pens, nudibranchs and crustaceans may be the highest in the world. By contrast, the freshwater fauna is poor, but fish, crayfish, turtles and crocodiles are important components in the lower and middle reaches of rivers and some lakes.

31. Agriculture production is very sensitive to climate and climate variability. Crop growth and yield is influenced by inter-annual variations in weather, nutrient status of soils and temperature. Climate change will affect soils primarily through changes in soil moisture, soil temperature and soil organic matter content. The vulnerability of crops to climate change may either be increased or diminished by future technological changes. If technological advances narrow the optimal range of input conditions for agricultural production (e.g. need for high levels of fertilizer), and if climate change results in increased variability such as increases in frequency of droughts as well, production risks may also be expected to increase.

32. It appears from the foregoing that agriculture, coastal zones, water resources, human health, biodiversity (marine and terrestrial), and fisheries are considered very important sectors of the economy. These sectors are also provide the basis of livelihood for the majority of the population in the country, 80% of which is rural-based.

33. Papua New Guinea is richly endowed with natural resources, but exploitation has been hampered by rugged terrain and the high cost of developing infrastructure. Agriculture provides a subsistence livelihood for 85% of the population. Mineral deposits, including oil, copper, and gold, account for nearly two-thirds of export earnings. The economy has improved over the past three years because of high commodity prices following a prolonged period of instability. The government has also brought stability to the national budget thus far, largely through expenditure control. Numerous challenges still face the government including regaining investor confidence, restoring integrity to state institutions, promoting economic efficiency by privatizing moribund state institutions, and balancing relations with Australia, the former colonial ruler. Other socio-cultural challenges include the HIV/Aids epidemic, law and order, and land tenure issues.

#### Ratification of UNFCCC

34. PNG is very much aware and concerned about environmental degradation and global warming and their detrimental effects. Thus, PNG ratified the United Nations Framework Convention on Climate Change (UNFCCC) on 16 March 1993, and has submitted its Initial National Communication (INC) on 02 February 2002. Following the preparation of its INC the country has initiated efforts to create an institutional set-up that seeks to mainstream environmental decision-making through the establishment of the *Environment Council* under the Environment Act 2000, which is a testimony to the importance given to, and the role environment plays in the life of Papua New Guineans.

35. Ratification of the UNFCCC is one step forward in terms of commitment to addressing climate change and related issues. Papua New Guinea 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 March 28 2002.

36. PNG has embarked on the implementation of sustainable development programmes which have strong linkages to its reporting commitments under other multilateral environmental agreements. These reports include its contribution to World Summit on Sustainable Development (WSSD) and Johannesburg Plan of Implementation (JPOI), Barbados Programme of Action for Small Island Developing States (BPoA) and International Meeting in Mauritius (IM), and National Biodiversity Strategy and Action Plan (NBSAP) under the Convention on Biological Diversity (CBD) and the National Actions Plans for combating desertification (NAPs) under the United Nations Convention on Combating Desertification (UNCCD) . The country is currently implementing a programme to identify its urgent and immediate needs for capacity-building relating to the implementation of the UNFCCC, CBD and the UNCCD through National Capacity Self Assessment (NCSA), with the support of the GEF and UNDP.

## **2.2 Stakeholder Analysis**

### Process and approach used

37. The consultations on Pacific Adaptation to Climate Change (PACC) were conducted by the PDFB team<sup>1</sup> and involved eight stakeholder consultations and workshops and several 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,
- c) A national consultation workshop on PACC priorities.

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

#### Institutions and individuals involved/consulted

39. A total of four ministries, agencies and institutions of government in Papua New Guinea involving 15 experts were consulted during the in-country consultations and workshop. These consultation workshops provided the opportunity for all individuals and organizations to be informed about PACC objectives, priorities and activities and also to consider some of the common elements or priority activities for adaptation implementation. The consultation meetings were usually carried out over 1-2 hour sessions. Thus, in total 12 hours of consultations were held spread over five days.

40. The PACC Consultation Team (PCT) first met with the staff of the Greenhouse Unit, Department of Environment and Conservation (DEC). The PCT informed the meeting on the PACC priorities and activities that could be funded under the project. In response the DEC outlined the role and responsibilities of DEC and emphasized the need for further studies to be undertaken in communities in order to ascertain how these communities deal with issues/problems relating to agriculture and food security, coastal zone management and water resources management. PCT pointed out that while further assessment is necessary in all areas the focus of PACC is to implement adaptation measures in development sectors to enhance resilience and adaptive capacity over the long term. DEC also outlined various climate change-related activities which have been carried out in the Papua New Guinea including Enabling Activities of the GEF (national communications and national capacity self-assessment). In addition a number of other enabling activities are being carried out: national biodiversity strategy and action plan, national action plan and sustainable land management programmes.

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<sup>1</sup> Chief Technical Adviser, UNDP Programme Officer and GEF Expert Consultant

41. The PCT met with the Head of the Water Resources Division (WRD) of Department of Environment and Conservation to discuss possible activities that could be funded under the PACC project. After PCT presented the objectives of the PACC and the process by which PACC priorities would be defined the Head of WRD indicated the only assessment work undertaken was a demonstration project in one of the catchment areas of Port Moresby. She further informed that further assistance has been provided by SOPAC in the areas of training and capacity-building as well as providing technical assistance to the Papua New Guinea. Further support for water resources assessment will be provided through the Integrated water Resources Management project and the Pacific HYCOS programme to be implemented by SOPAC.

42. The PCT also had consultations with the Head of the Marine Sector of the DEC who indicated that two pilot projects on coastal zone management were completed and the division was currently involved in the marine conservation programme with Conservation International. However, to date there had been no comprehensive work undertaken for coastal zone management in the country.

43. Consultations with the Ministry of Agriculture and Livestock, Land Use section (DAL/LU) highlighted food production and food security as a critical part of the sustainable development policy of the Government of Papua New Guinea (GoPNG). At present a number of agricultural programmes are being carried out on farming systems in water stress areas where food sources are seriously affected by drought and lack of moisture. These programmes include Food and Agriculture Organization's (FAO) food security project focusing on lowland farming systems, FAO Technical Cooperation Programme on farming systems and the SPC-managed Development of Sustainable Agriculture in the Pacific with particular focus on farming problems with soil infertility, pests and diseases. Four sites in three provinces are being used as pilots under this programme.

44. In considering options for a pilot adaptation project DAL/LU suggested that food security / poverty alleviation and sustainable land management under conditions brought about by climate change and variability, require interventions urgently. It is also clear that for some places there are forms of intervention that can never be ignored and become inevitabilities themselves in that they have to be initiated - given the conditions of the natural environment - to create the environment conducive for activities aligned with food production and sustainable livelihood. Such is the inevitability of irrigation farming. This is an intervention long overdue in PNG that must be initiated for its dry drought-prone areas since a considerable proportion of the national population lives in this environment type.

45. Subsistence farming as a livelihood activity in a climatic zone which experiences six-month drought such as that of Central Province is limited to cultivation of drought-tolerant crops as well as those annuals with the short growing periods (from planting to harvest) usually within the 3 or 4-month period and hence able to be maintained under the climate condition. Those tolerant of the harsh dry conditions or periods of moisture deficit include the banana, cassava, and other minor crops. In the light of the dry conditions experienced annually DAL/LU suggested that the pilot adaptation project

under PACC should focus on food production and food security in the Central Province, Papua New Guinea.

46. In the consultations with the Department of Development Planning and Finance, it was noted that the overall framework for food security in the Papua New Guinea is embedded in the government's Medium Term Development Strategy 2005-2010. The focus of this framework is on rural development. There is strong collaboration with the Ministry of Agriculture in developing this broad strategic framework for food and food security. Additionally, the PCT was informed that Department of Finance and Planning coordinates all externally-funded programmes through its Aid Policy and Planning Directorate. With respect to co-financing, opportunities exist for co-financing of PACC activities and agreed that co-financing will be available to support PACC implementation which could be financed through the project improvement programmes.

47. It is clear from the foregoing that climate change impacts are slowly being felt across a broad spectrum of society, particularly in food production and food security. While the main focus of many of the activities carried out by various organizations is not necessarily climate change oriented, most activities undertaken could be included as adaptation activities over the long term due to their veracity as sound environmental and sustainable management of resources in the Papua New Guinea.

#### Wrap up meeting

48. The PACC team presented their findings at a luncheon meeting with all members of the NCCCT (stakeholders) who were consulted during the week. The agenda focused mainly on the proposed focus for PACC Papua New Guinea (PACC-Papua New Guinea) as well as the proposed institutional arrangements. Issues that have been raised and agreed upon included:

- a) The endorsement by NCCCT to focus on food production and food security thematic area as well as the proposed pilot location in Central Province. Central Province experiences drought almost every year and the situation worsens with the onset of ENSO. Recent assessments of the food situation in Central Province indicated that it is an urgent priority for PACC-Papua New Guinea;
- b) The expected size for PACC-PNG pilot is expected to be up to USD800,000;
- c) The expected ratio for co-financing to be applied in this pilot project is 1:4 (i.e. for every dollar of the GEF resources there should be four dollars from other sources). A suggestion was made that a joint DEC-DAL submission for extra funds under the Project Improvement Programmes to co-finance additional adaptation activities under PACC in the pilot area.
- d) On institutional arrangements, the National Climate Change Country Team (NCCCT) has endorsed that the project management unit be set up directly under the Land Use section of the Department of Agriculture and Livestock, with the NCCCT, as the advisory body on scientific, technical, policy and management issues. The terms of reference (TOR) for the PMU and management arrangements will be developed and will include a provision for the PMU to be accountable to the DAL, NCCCT, UNDP and SPREP for the project.

### **2.3 Climate change programmes, projects and activities**

49. A number of climate change programmes, projects and activities have been carried out in SI since the entry into force of the UNFCCC. PNG prepared and submitted its initial national communication to the UNFCCC on February 02 2002. At present PNG has been preparing its national capacity self-assessment to identify its capacity needs relating to individual, institutional and systemic capacities to implement the UNFCCC. It has recently embarked on the preparation of its second national communication with funding support from the GEF.

## **III. SECTORAL ANALYSIS**

50. 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. Thus one of the objectives of in-country consultations was to determine detailed adaptation activities and baselines in each country.

### **3.1 Methodology/criteria for selection of priority sector**

51. 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 GoPNG's existing programmes
- b) All necessary baseline assessments carried out, and additional activities are ready for implementation, and,
- c) Ability to co-finance and ability to deliver.

52. The results of the consultations were presented in a workshop which brought together all the stakeholders who had been consulted on the PACC project during the week. The purpose of the workshop was to allow stakeholders to discuss, agree on and endorse the priority sector for PACC, the location and the institutional arrangements for implementation of adaptation activities.

#### Focal area for adaptation

53. Based on these three criteria and on the stakeholder consultations (see section 2.2) food production and food security was selected as a priority sector for adaptation intervention in Papua New Guinea under the PACC project. Under this theme, an adaptation project entitled

**“Piloting climate change adaptation in food production and food security in Central Province, Papua New Guinea”** was proposed for PACC-Papua New Guinea. This project would focus on enhancing, and where necessary, developing adaptation measures (hard and soft solutions) in a pilot site in the Central Province which is often affected drought on annual basis.

54. The lowland dry subhumid region of Central Province (CP) is a stretch of coastal area running some 200+ kilometres east – west in parallel with the southern coast of the mainland of Papua New Guinea. To any one who is from, or has travelled to, other parts of PNG, the significant characteristic typical of this region is its dryness. This is an area where there is a significant period of drought of between 6 months, more or less, with the other half of the year having rains. This region (CP) is amongst those in less than five (5) provinces of PNG. The other provinces where this climate type is experienced are Milne Bay (Rabaraba), Morobe (Markham Valley), Madang (Ramu Valley), East Sepik (Sepik Plains), and some parts of East New Britain (Gazelle Peninsula). There are some more parts of the country, for instance Western Province but the ones listed above are known throughout the country for this climate type.

55. According to the standardised classification system devised for classifying all the major climatic types / regimes of PNG (Mc Alpine, 1983), the main characteristics pertaining to the lowland subhumid climate type include mean annual precipitation (rainfall) of 1300mm within a range of 1000 – 1500mm; mean annual evaporation (determined by the US Class A Pan method) of 2200mm; P/E (Precipitation /Evaporation) ratio of <1; and mean annual maximum temperature of 32 °C and minimum of 23 °C. The resultant vegetation type is savanna and / or savanna grassland

56. The major climatic influence is the position of the Inter-Tropical Convergence Zone (ITCZ) and the change in prevailing winds that results from its movement north and south. Between May and October, when the ITCZ lies to the north of PNG, southeast winds prevail. The southeast season, in most places, produces little rain. From December to April, when the ITCZ lies to the south of PNG, strong northwest wind prevails. This season brings most parts of PNG its heaviest rainfall. The predominant orientation of high mountain ranges causes for some places, the normal ‘wet’ and ‘dry’ seasons to be reversed. Large areas of PNG normally receive over 4,000 mm of rain each year. A number of much smaller areas receive less than 1,000 mm, most of which is received in one ‘wet’ season. Lowland areas experience constantly high temperatures throughout the year with maximums between 28 and 34°C and minimums between 20 and 25°C. In general, the lapse rate is 0.5°C per 100 m of altitude. Highland valleys experience maximums of between 20-29°C and minimums of 10-18°C. At altitudes above 2,000 m, minimum temperatures can fall below zero during the southeast season when night skies are clear of cloud.

57. About every 6 to 13 years PNG suffers from a lack of rainfall in many parts of the country, including those parts that do not “normally” have a dry season. These events are almost always without fail associated with what is known as the ENSO. While there is a pattern to the SO, it is not a regular one and is therefore difficult to predict. This is because the most important factor in driving this phenomenon is the temperature of the sea surface, which receives heat from the sun. The sea is a huge body of water and the way in which it absorbs holds and releases heat is not yet well understood. Normally, the sea surface in the western Pacific is warmer than that of the eastern Pacific. As a result, air rises high over

PNG, moves east across the Pacific at a high altitude where it descends and returns back across the Pacific as westerly winds. When the sea is warmer and the air pressure is lower, large amounts of water can be absorbed by the air and be carried over the land to be released as rain. The outcome is very high rainfall over much of PNG much of the time. El Nino event occurs when the sea surface in the eastern Pacific (near Chile) begins to warm. As the El Nino develops, the sea surface in the western Pacific becomes cooler than that of the eastern Pacific and the circulation of air across the Pacific reverses and goes in the opposite direction. Under these conditions cooler drier air descends over PNG. Cooler, descending air carries little water and causes higher air pressure. When this happens PNG experiences low rainfall and clear skies with little of the usual large amounts of cloud. By examining government reports, newspapers and oral accounts, it is possible to count the years in which a range of outcomes associated with severe ENSO events have occurred in PNG. These outcomes are drought, repeated frost, food shortages, bush fires and migrations. In 11 of the 125 years between 1877 and 2002 all these events occurred, or can safely be assumed to have occurred, with a frequency of 12 years, on average. This suggests that about 85 per cent of all severe ENSO events have serious outcomes in PNG (Allen B., 2003)

58. It is clear that some major regional environmental relationships govern or influence climate variability throughout the region of interest; firstly, laterally in parallel with the coastline or in a vertical direction as one moves inland. This is verified by rainfall data collected for the region that shows increase of precipitation levels as one moves east or west out of Port Moresby or inland into the Sogeri Valley area and beyond; for instance.

### **3.2 Assessment of priority sector for adaptation activities**

59. Because the major issue in constraints to farming within this region is soil moisture deficit (which is mainly conditioned by the climate type and influenced in the subsequent stages by soil texture), the concept of soil water balance is an important one for considerations in soil moisture assessment and management. For this reason, soil water balance is used to determine the frequency and intensity of soil moisture stresses throughout the year. It simply gives a reliable guide to determining water availability throughout the year.

60. Soil moisture estimates will vary depending on the different soil types; but in this case, the estimates are derived from the difference in estimated evaporation and rainfall. This is the method used by McAlpine and Short (1974) in determining water balance estimates for PNG. Water surplus refers to run-off here or excess water that collects in an area and is discharged into a waterway of some sort. Details of determining values for water surplus can be referred to McAlpine and Short (1974).

61. According to McAlpine et al, (1983); the Port Moresby area and areas with similar climate types regularly experience serious drought conditions during the months of dry season. From the above graph it can be seen that both soil moisture and average rainfalls follow a similar pattern. The average soil moisture level that may be attained is about 75 mm, and this usually occurs in conjunction with the onset of the wet season from late December to mid May. Soil moisture levels are at their highest (upper limit of 150 mm) during February and March. After May (onset of the dry season), the soil moisture levels

dramatically decline. Very severe drought cases may occur during the six to seven- months dry period (McAlpine et al, 1983).

### ENSO and Drought

62. Drought in the lowlands of Central Province are usually associated or influenced by EL Nino-Southern Oscillation (ENSO) phenomenon. It is estimated that ENSO events in PNG occur once every 8-13 years and the country had experienced no less than 13 droughts were recorded over the last 120 years in PNG (Allen 1997). Almost in all cases, the lowland areas of Central Province were seriously affected by drought as a result of these ENSO events. The most recent severe drought occurred in 1997-1998 period (dubbed “most serious drought of the century” in the country).

63. In areas which have regular seasonal periods of low rainfall and severe seasonal soil-water deficits, agricultural systems are adapted to deal with these conditions. Where dry seasons are very severe, people have found some other way to deal with the constraints that the lack of rainfall places on food production. For example, in many places that have severe dry seasons, trading is very important. Along the Central Province’s coast, where there is a severe regular dry season, mountain people trade pots for sago from the Gulf of Papua, where there is no dry season but where there is usually a large soil-water surplus. In Milne Bay, islanders travel long distances over open seas in sailing canoes to trade for food with people on larger islands and on the mainland. In many places today, these trading systems have become defunct. Where people can now earn cash, they use it to buy supplementary food, usually imported rice or flour, to get them through the dry season. Where they cannot earn cash, living conditions have deteriorated.

### **3.3 Current institutional and development baseline activities**

64. Policy/regulatory framework for Food Production and Food Security is embedded in the National Food Security Policy 2000-2010 wherein it aims “to increase and diversify food production in order to achieve greater self-sufficiency in food and attain food security at the national and household levels by the year 2015.” The policy further emphasizes the need to increase agricultural production and productivity, income earnings and domestic marketing and exports and to ensure that all people at all times have access to safe and nutritious food in adequate quality and quantity to maintain a healthy and active life.”

65. Additionally the Medium-Term Development Strategy 2005-2010 focuses on export-driven economic growth, rural development and poverty reduction, enhancing food security through income-generating opportunities. Thus the two national policies for development are consistent with the aspirations plans of the GoPNG.

66. Almost all climate change activities are carried out within and coordinated by the Department of Environment and Conservation who also serve as the operational focal point for the UNFCCC and the GEF. DEC implements programmes, projects and activities relating to sustainable use of resources and the protection of the environment. DEC also works very

closely with other partners such as the Ministry of Finance and Planning, and relevant line ministries and donor-community.

67. With respect to the PACC project, adaptation implementation will involve a number of stakeholders including Ministries of Finance and Planning, Ministry of Agriculture, Meteorological Services, the communities and villages where the pilot activities will be carried out. Other stakeholders to be involved in food production and food security issues including National Disaster Management Office and the NGO community where appropriate. However, while these organizations' involvement and participation in food production systems and food security issues have been driven by their mandates, there is low/weak institutional coordination. This affects the flow and exchange of information and knowledge regarding the infrastructure and activities relating to food production and food security in the country. For example baseline information on food production and food security exists for some parts of the country, while climate information is only available for areas/stations that have observation equipment installed.

### **3.4 Impacts of climate change on the priority sector**

68. Climate change could pose problems in the future for the GoPNG as impacts from weather and climate extreme events, which are now being experienced. For example, the 1978, 1981/1982 and 1997/1998 El Nino events significantly devastated the country's economy. From current baseline data and information about the country's weather, climate trends and inter-annual variations in sea level rise, the following is the summary:

- a) Both the temperature and precipitation trends in PNG resemble the global and regional trends respectively;
- b) The increases in the mean near surface temperatures especially over the last 25 years appear to be above the global mean;
- c) The increase in the mean minimum temperatures has been greater than that of the mean maximum temperatures since 1970;
- d) The detection of climate change is still uncertain as it is based on the current data sets which have a short period of observations;
- e) The dry seasonal patterns exhibit weakening La Niña impacts during dry season and that the weakening is eventually influencing the weak dry conditions. This implies longer decadal phases of dry conditions;
- f) There's an obvious need for a widespread climate network to effectively monitor climatic variables unique to this part of the world. This may include careful observation of the northwest monsoonal flows necessary for the detection of the onset of the El Niño episodes;
- g) There is already a relative sea level rise around the country, but this is strongly influenced by El Nino and La Nina signals.

69. Agriculture production is very sensitive to climate and climate variability. Crop yields are influenced by inter-annual variations in weather, nutrient status of soils and temperature. Climate change will affect soils primarily through changes in soil moisture, soil temperature and soil organic matter content. The vulnerability of crops to climate change may either be increased or diminished by future technological changes. If technological advances narrow the optimal range of input conditions for agricultural production (e.g. need

for high levels of fertilizer), and if climate change results in increased variability such as increases in frequency of droughts as well, production risks may also be expected to increase.

70. The direct effect of increased temperature generally decreases photosynthesis at temperatures above 25°C for tropical crops like sweet potato, cassava, taro and yams. In PNG (high island country), rising temperature will raise the upper altitude limits at which tropical crops can be cultivated. Higher temperatures will affect agricultural productivity, whereby farmers will be subjected to heat stress due to high temperature and humidity.

Other effects of rising temperatures include:

- a) Rapid post-harvest deterioration of crops;
- b) Greater rate of water loss through evaporation, especially in limestone areas, leading to greater occurrences of droughts in low-lying areas, and a decline in soil fertility;
- c) Flooding of low lying areas if accompanied by higher rainfall. Soils will suffer greater leaching and loss of fertility and the humid conditions will favor increased incubation of agricultural pests and diseases;
- d) Shorter time for crops to mature, hence smaller produce and thus, a lower overall yield.

### **3.5 Method for assessing priority sector baseline**

71. Water balance model was used to assess the baseline conditions of the pilot site. The assessment indicates that central Province experiences 6 months of dry season annually and with the onset of ENSO conditions drought is often prolonged. In addition the area contains a sizable population up to 183,000 people. Based on the water balance model and rainfall and temperature data there is no doubt that this area experiences drought of 6 or 7 months in length every year. Other factors include:

- a) A considerable proportion of the population of PNG (including Central Province lives (and is marginalised on several fronts) under this climate type
- b) Unquestionably, cases of hunger and poverty clearly prevail and this situation is aggravated or would be influenced by the marginal conditions for agricultural productivity created by the dry climate
- c) Relevant authorities have over the decades been merely telling locals within this area the fact that agriculturally their area is marginally suitable for agriculture because of the climate. No land improvement programs have been considered because the concerned / affected areas spread over a large region (several Districts of the province) and hence initiatives for interventions for improvement (e.g. irrigation) have to be regional in scope. Clearly then, the envisaged costs have always become the deterrents.
- d) People living in this type of environment have come to admit and accept the fact of their land being climate-marginalised for agricultural productivity. For villagers within and / or outside of the National Capital District (Port Moresby City), the

“bright city lights” and urban drift are an easy excuse for idleness. Clearly, a climate-marginalised environment and urbanisation together create a favourable setting conducive to idleness that leads to hunger and poverty.

- e) Considerations for accessibility also make Central Province a good location for the project. Port Moresby City (NCD) is situated in this climate type / region and is where the major government agencies such as DEC and DAL are located. Jackson’s International Airport is located within the city boundaries. National highways thread east and west of the city for up to more than 200 kilometres in both directions.

### **3.6 Determination of additional adaptation activities**

72. Given that climate change affects the whole area it is important to consider additional adaptation activities that transcend the two main focal/thematic areas such as food production and food security, and water resources management. Additional adaptation activities would include protection and improvement of soil fertility and conservation and changes in cultivation methods including the use of irrigation to enhance food production.

73. Similarly, a low cost and low-input irrigation system will be developed as well as the possibility of infiltration galleries to hold water for irrigation during the dry season. Thus a detailed survey of topographic features of an pilot area integrated component of additional adaptation activity to determine water quality and quantity testing as well as groundwater investigation to ascertain the extent of the availability of ground water for irrigation.

## **IV. DELIVERY MECHANISM FOR FULL-SIZE PROJECT**

### **4.1 Institutional Arrangements**

74. All climate change programmes, projects and activities are being coordinated by the Greenhouse Unit of the DEC. The climate change section has two staff who 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 Greenhouse Unit section also served as a secretariat for the National Climate Change Country Team under the project on the preparation of initial national communication under the UNFCCC.

75. Under the PACC-PAPUA NEW GUINEA project, the Greenhouse Unit will continue to coordinate climate change activities relating to PACC. However, given that PACC is focused on implementation of adaptation activities, the implementing agency for PACC-PAPUA NEW GUINEA will be Ministry of Agriculture and Livestock, Land Use Section (DAL/LU), who will execute the pilot project. The main partners in this project will include the National Disaster Management Office, Department of Environment and Conservation, national Planning Office (Aid Coordination), Department of Water Resources Division, Department of Lands and Surveys, Department of Works, relevant Provincial government authorities, non-government organizations. DAL/LU will also serve as secretariat to the proposed National Advisory Committee on Climate Change (this will replace National

Climate Change Country Team) (PNGNACCC) on issues relating to the technical, scientific, policy, and management oversight to the implementation of PACC-PAPUA NEW GUINEA.

76. In addition to the execution and implementation of PACC-PAPUA NEW GUINEA, DAL/LU 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) which will be directly responsible to the Director of DAL/LU.

77. At the national level, PACC-PAPUA NEW GUINEA will be implemented by various stakeholders within their respective mandates while scientific, technical and policy oversight will be provided by the PNGNACCC which will comprise of representatives from various government ministries, agencies and institutions, the private sector and non-government organizations.

#### **4.2 Assessment of existing and potential barriers to adaptation implementation**

78. PACC-PAPUA NEW GUINEA is underpinned by GoPNG policy and regulatory framework on Food production and food security and its strategy for rural development. The project will also be supported by a number of climate change enabling activities (e.g. national communication and national adaptation programme of action) that have also involved numerous organizations, institutions and individuals in carrying out various tasks and activities. These activities have been supported by the NCCCT through the provision of scientific, technical, policy and management oversight and guidance. Thus many of the roles and responsibilities have been clarified but some barriers still remain and will have to be overcome in order to improve delivery of the PACC-PAPUA NEW GUINEA. Some of these barriers include, competing demands on staff time, inadequate staff resources, equipment, and lack of incentives.

79. 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**

80. The main goal of this project is to “increase the resilience and enhance adaptive capacity of communities, socio-economic activities and infrastructure”. This goal will be achieved through a project “Piloting climate change adaptation in food production and food security in Drylands of Central Province, Papua New Guinea.” This project will also focus on enhancing, and where necessary, increasing food production and improving food security in a communities/villages. The implementation of adaptation activities relating to food production and food security entails a myriad of activities that will also transcend land and water resources management.

#### **Goal:**

81. The main goal of this project is to enhance the capacity of Papua New Guinea to adapt to climate change, including variability, in selected key development sectors.

**Specific Objective:**

To “increase the resilience and enhance adaptive capacity of communities, socio-economic activities and infrastructure”.

**Specific Outputs:**

Output 1.1: Relevant plans and programmes incorporate climate risks in the food production and food security sector in Papua New Guinea.

Output 2.1: Practical guidance to design underground irrigation networks to adapt to current drought situations and future rainfall regimes.

Output 2.2: Practical guidance to design underground irrigation networks to adapt to current drought situations and future rainfall regimes demonstrated (with co-financing support)

**Description:**

Output 1.1: Relevant plans and programmes incorporate climate risks in the food production and food security sector in Papua New Guinea.

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.

Output 2.1: Practical guidance to design underground irrigation networks to adapt to current drought situations and future rainfall regimes.

Output 2.2: Practical guidance to design underground irrigation networks to adapt to current drought situations and future rainfall regimes demonstrated (with co-financing support).

71. This output will assist the Department of Agriculture and key stakeholders including communities to develop their capacity to design and demonstrate innovative programmes that would assist them address one of PNG's main vulnerability, which is drought. Over the years PNG have been plagued with drought and the Central Province is one of the most affected areas. The lowland dry sub-humid region of Central Province is a stretch of coastal area running some 200+ kilometres east – west in parallel with the southern coast of the mainland of Papua New Guinea. In 1997, the Papua New Guinea government declared a state of emergency as concern over the food situation of the country mounted. Official reports showed that up to 1 million people were affected by the drought conditions and faced food shortages. Large numbers of people who relied on home gardens were reported to have deserted villages in search for food as drought resulted in widespread bushfires destroying homes, crops, grasslands and forests. On March 4th 1998, the Treasury Minister advised Parliament that the country had lost 500 Million Kina (USD 300 million) in foreign exchange reserves as a result of the prolonged drought.

72. A pilot demonstration would be undertaken at Kivori Poe which is located approximately 190km out of Port Moresby in the Kairuku District in the Central Province. This is an area where precipitation is greatly reduced during 6 months of the year. The site is an area of about 2000 hectares of flat to gently undulating terrain covered mainly by grassy and scrub vegetation, scattered eucalyptus and mango trees. There is a population of just over 1000 residing in one main village, Kivori Poe, and three separate settlements, which branched out from this village. In an effort to address the issue, the

government has currently committed US\$3 million as part of its recurrent budget on food production and security to carry out assessments and research on how farmers in the Central Province and also other similar vulnerable areas around the country would be able to sustain production of food crops. This project would contribute towards this endeavor and activities to be undertaken would include:

- Setting up of a multidisciplinary PACC Core Technical Team;
- Application of climate models and using modern and traditional knowledge to design and demonstrate low input/low technology irrigation networks and diversification options for a range of food crops resilient to drought conditions
- Design an overall land use plan for the pilot area
- Design, conduct training and demonstrate use of low input/low technology irrigation systems to reduce impacts of drought on crop yields
- Piloting alternative cultivation practices that enhance resilience of farming systems to drought conditions
- Strengthening networks and information sharing/exchange amongst farmers/stakeholders to enhance adaptive capacity to climate change
- Developing a climate change and climate variability database and collect data on food-crop responses to irrigation and relevant indicators to monitor and evaluate their impacts.

## **PROJECT LOG FRAMES AND INDICATORS**

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



	71600	Travel	20,000	4000	4000	4000	4000	4000	20,000
	72100	Contractual Services - Co							0
Subtotal			<b>20,000</b>	<b>4000</b>	<b>4000</b>	<b>4000</b>	<b>4000</b>	<b>4000</b>	<b>20,000</b>
Outcome 4			<b>88,758</b>	17752	17752	17752	17752	17750	<b>88,758</b>
Subtotal			<b>88,758</b>	17752	17752	17752	17752	17750	<b>88,758</b>
<b>Total</b>			<b>918,758</b>	<b>191,752</b>	<b>257,852</b>	<b>212,352</b>	<b>141,452</b>	<b>115,350</b>	<b>918,758</b>

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## **ANNEX**

### **Detail PACC Activities**

Output 2.1: Practical guidance to design underground irrigation networks to adapt to current drought situations and future rainfall regimes.

Output 2.2: Practical guidance to design underground irrigation networks to adapt to current drought situations and future rainfall regimes demonstrated (with co-financing support).

Activities	Responsibility	Budget	Assumption	Comments
<b>Preparatory and Planning Phase</b>				
1. Set up a multidisciplinary PACC management team and technical team	DEC, DAL, CPA			Tasks include field monitoring and evaluation; explore possibility of appointing a Project Officer for PACC
2. Conduct awareness-raising on Pilot Project concept to local communities	DEC, DAL			Ongoing activity
3. Conduct land use study and environmental assessment of the pilot area	DAL – Land Use; DEC			Use PRA approach
4. Design project specification on sourcing and supplying underground water and water harvesting catchment, taking into consideration current and future changes in climate, and develop an overall land use plan	DAL, DEC, CPA			Project plan will have 3 major components: i) appropriate low input irrigation system, ii) water harvesting, and iii) adaptive cropping systems
5. Procurement of materials and equipment	DAL, CPA			Apply cost effective measures
<b>Implementation (of Project Plan)</b>				
6. Layout irrigation and water entrapment scheme/system	DAL, NARI			Outsourced to contractors. Includes drilling of boreholes.
7. Applying improved farming systems	DAL, NARI			Introducing irrigation farming system, drought resistant crop varieties, dry land rice, small livestock, etc.
8. Capacity building of technical officers and targeted farmers on irrigation farming	CPA, NARI, DAL			To ensure sustainability of Project
9. Replicate to another part of PNG with similar problems using lessons learnt from PACC.	CPA, NARI, DAL			
<b>Monitoring and Evaluation</b>				
9. Quarterly and annual review of Project progress	PACC management team/coordinator			Enable sound decision-making; facilitate information dissemination (field results) and networking
10. End of Project evaluation	PACC management team/coordinator			Evaluation outcomes (lessons learned) will define criteria for replication to other sites



Output 2.2 Policy/Decision makers integrate adaptation to climate Change concerns within MTDS, Organic law on PLLGA, Environment Act 2000, NADP.				
2.2.1. Implement Mainstreaming process within national policies such as MTDS, Organic law on PLLGA, Environment Act 2000 and NADP.				
2.2.2. Implement Mainstreaming process into sectoral policies.				
Output 2.3 Developed and enhanced capacity of stakeholders to integrate CC concerns into national/sector/cluster policies, plans and programmes.				
2.3.1 Identify capacity of Stakeholders to absorb and facilitate CC adaptation into their programs.				
2.3.2. Identify relevant CC training for stakeholders.				
2.3.3. Collaborate with stakeholder partners to provide appropriate CC training.				
2.3.4. Evaluation				
Output 2.4 Enhanced awareness & education campaigns to address climate change adaptation issues				
2.4.1. Identify information gaps on CC adaptation within the middle to senior decision makers in relevant government department.	DEC DAL- PACC/PMU			
2.4.2 Develop appropriate information for decision makers.	DEC DAL- PACC/PMU			
2.4.3. Conduct internal training workshops on CC adaptation.	DEC DAL- PACC/PMU			
2.4.4. Disseminate information using appropriate medium for provincial policy makers and planners.	DEC DAL- PACC/PMU			
Outcome 3: Regional Cooperation				
Output 3.1 Best Practices and lessons exchanged among Provinces of PNG with similar agroecological zones.				
3.3.1 Establish a provincial and local level database system for climate change				Create web page on <a href="http://www.IGR.com.pg">www.IGR.com.pg</a> Other links to be created with DAL/LU and DEC and <a href="http://www.PNGndc.gov.pg">www.PNGndc.gov.pg</a> <a href="http://www.sprep.org">www.sprep.org</a> <a href="http://www.spc.int">www.spc.int</a>
3.3.2 Packaging of appropriate information to target different stakeholders				
3.3.3 Conduct seminars with policy and administrators at the provincial and local level				Provincial level website for PNG - <a href="http://www.IGR.com.pg">http://www.IGR.com.pg</a>
4 Conduct awareness campaigns at ward level				

Budget Item	Description of Expenditure	BUDGET (USD)				
		STATE			PACC	Any other
		IN KIND	CAPITAL	OPERATIONAL	GEF	Co-funding
1.1.1. Conduct awareness-raising on Pilot Project concept to local communities					\$40,000.00	
1.1.2. Conduct groundtruthing and environmental assessment of pilot area					\$10,000.00	
1.1.3. Design project specification on sourcing and supplying underground water and water harvesting catchment, taking into consideration current and future changes in climate, and develop an overall land use plan					\$70,000.00	
<b>Sub Total</b>						
1.1.4. Layout irrigation and water entrapment scheme/system					\$150,000.00	
1.1.5. Applying improved farming systems					\$40,000.00	
1.1.6. Capacity building of technical officers and targeted farmers on irrigation farming					\$20,000.00	
1.1.7. Facilitate upscaling of underground water irrigation					\$70,000.00	
1.1.8 Replicate to another part of PNG with similar problems using lessons learnt from PACC.					\$119,000.00	
<b>Sub Total</b>					<b>\$519,000.00</b>	
2.1.1. Develop a Climate Change mainstreaming framework					\$5,000.00	
2.1.2 Draft NEC policy submission for formal adoption of CC mainstreaming process.					\$2,000.00	
2.1.3. Initiate mainstreaming of CC into National Plans and policies.					\$20,000.00	
2.1.4. Incorporate the design and experiences of underground irrigation into NADP.					\$2,000.00	

2.2.1. Implement Mainstreaming process within national policies such as MTDS, Organic law on PLLGA, Environment Act 2000 and NADP.					\$16,000.00	
2.2.2. Implement Mainstreaming process into sectoral policies.					\$20,000.00	
2.3.1. Identify information gaps on CC adaptation within the middle to senior decision makers in relevant government department.					\$2,000.00	
2.3.2 Develop appropriate information for decision makers.					\$20,000.00	
2.3.2. Conduct internal training workshops on CC adaptation.					\$8,000.00	
2.3.4. Disseminate information using appropriate medium for provincial policy makers and planners.					\$20,000.00	
<b>Sub Total</b>					<b>\$115,000.00</b>	
3.1.1. Establish a provincial and local level database system for climate change					\$10,000.00	
3.1.2. Packaging of appropriate information to target different stakeholders					\$25,000.00	
3.1.3. Conduct seminars with policy and administrators at the provincial and local level					\$20,000.00	
3.1.4. Conduct awareness campaigns at ward level					\$20,000.00	
<b>Sub Total</b>					<b>\$75,000.00</b>	
4.1.1. Set up a multidisciplinary PACC management and technical team					\$1,000.00	
4.1.2. Project Management Unit					\$80,000.00	
4.1.3. Quarterly and annual review of Project progress					\$5,000.00	
4.1.4. End of Project evaluation					\$5,000.00	
<b>Sub Total</b>					<b>\$91,000.00</b>	
<b>GRAND TOTAL</b>					<b>\$800,000.00</b>	

