



VANUATU NATIONAL COMMUNICATION

TO THE

CONFERENCE OF THE PARTIES

TO THE

**UNITED NATIONS FRAMEWORK
CONVENTION ON CLIMATE CHANGE**

JULY 1999

Vanuatu National Communication

to the

Conference of the Parties

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United Nations Framework Convention on Climate Change

July 1999

FOREWORD

The potential environmental, economic and social impacts of Climate and Sea Level Change motivate Vanuatu's commitment to participating effectively in international effort to combat global warming and Sea Level Rise. Vanuatu is a party to the United Nations Framework Convention on Climate Change (UNFCCC), and took an active part in the initial negotiations in the development of the convention through its affiliations with Alliance of Small Island States (AOSIS) and Small Island Developing States (SIDS).

Climate Change and Sea Level Rise has been recognised as issues that require timely and committed initiative by government to develop capacity to address existing and potential impacts on the livelihood of the people of Vanuatu.

The National Communication is the primary mechanism through which our international commitments will be met. The Communication has been developed by the national government in consultation with the six provincial councils and the two municipalities of Port Vila and Luganville. Therefore, it maintains a comprehensive approach toward tackling Climate and Sea Level Change issues. The range of actions it encompasses reflects the wide-ranging causes of the enhanced Climate Change and Sea Level Rise effect and the pervasive nature of its potential impacts on all aspects of ni-Vanuatu life and economy.

The national communication focuses on six fronts:

- ◆ Institutionalise and mainstream climate change preparations,
- ◆ Build national level understanding,
- ◆ Improving network for information transfer and coordinate adaptation and mitigation measures,
- ◆ Increase national capacity to prepare for and adapt to climate change,
- ◆ Minimise increases in national GHG emissions in the medium term, and;
- ◆ Increase community understanding of climate change and their preparedness.

Implementation of the national Implementation Strategy will foster better understanding and guidance in policy and planning developments toward achieving our national objectives, consistent with meeting our international commitment. The Communication demonstrates the commitment of the government to ensure Vanuatu bears its fair share of the burden in the worldwide effort to combat Global Climate Change, while recognising that our national interest lies in protecting jobs and maintaining competitiveness of Vanuatu's growing economic industry and improving the quality of life for all its citizens.

In endorsing this Communication, the national and provincial governments and the local communities demonstrate the commitment of government to an effective national climate change response.


Honourable Donald K. Manu
Prime Minister and Minister for Foreign Affairs

EXECUTIVE SUMMARY

Vanuatu's contribution to man-made global emissions of Greenhouse Gases (GHG) is minute by international standards. Most emissions come from the combustion of fuels for transport and electricity generation, with carbon dioxide the predominant GHG emitted. Given the small proportion of the population with ready access to transport and electric supplies, the importance of expanding these services for economic and social development, and the dependence of Vanuatu on imported technology and equipment, neither an absolute reduction in national GHG emissions nor a reduction in GHG emissions per head of population is an immediate goal. However strategies to promote electricity generation from solar, wind and tidal current energy sources in association with phased adoption of international best practices for power generation and engine design will minimise increases in GHG emissions. At present GHG Inventory is too crude to allow useful prediction of the level at which Vanuatu's emissions will peak or when this will occur.

National concern in this first report to the COP is focused on the potential impacts of climate change given the population's dependence on rain fed agriculture and subsistence gardening, the limited surface and ground water resources and the social and economic impacts of tropical cyclones. There is insufficient data at present to quantify impacts, to identify areas of high vulnerability and hence design appropriate adaptation policies. The action plan consequently emphasises activities that will address this lack of data and strengthens national capacity, especially at a national and provincial level, to meet this challenge.

The vulnerability of Vanuatu to sea-level change will, for the most part, be determined by the nature of ongoing development and the way in which Vanuatu manages its environment and resources. However, impacts will be inequitably spread through the islands of Vanuatu, with localised areas on low lying islands and areas experiencing subsidence due to tectonic and volcanic processes being most severely affected. In future plans the government will consider sea level change scenarios, and adopt strategies to minimise vulnerability of any new investments in infrastructure and services. Recognising this, further work is required to analyse the combined impacts of sea level change and tectonic processes on an island by island basis.

It is recognised that possible impacts of climate and sea-level change on the well-being of ni-Vanuatu people and their environment are immense. However, when considered in conjunction with social and economic development needs, as well as the nation's cultural and social aspirations, the dilemma for planners and government is how to divert scarce economic and human resources from immediately pressing development needs to prepare for the less tangible and longer term impacts of climate change. One option recognised in this first report to the COP is to integrate climate change considerations with multi-sectoral activities, and to institutionalise integrated social, environmental and development planning.

Due to Vanuatu's limited technical and financial capacity and the global nature of climate change and sea level impacts there is a role for further international cooperation in meeting these goals and on-going work to minimise increases in emissions.

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- Bue, Nathaniel and Viji, Ione (1999) Greenhouse Gas Inventory, Vanuatu. Unpublished report to the NACCC.
- Marav Smith, A and Mawa, P. 1999. Draft vulnerability and adaptation to climate and sea level change. Unpublished report to the NACCC.

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Abbreviations

COP1	First Conference of the Parties to the UNFCCC
COP2	Second Conference of the Parties to the UNFCCC
DESD	Department of Economic and Social Development
ENSO	El Nino Southern Oscillation
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHGs	Greenhouse Gases
NACCC	National Advisory Committee for Climate Change
NDMO	National Disaster Management Office
IPCC	Intergovernmental Panel on Climate Change
SIDS	Small Island Developing States
SPREP	South Pacific Regional Environment Programme
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VNCW	Vanuatu National Council of Women
WMO	World Meteorological Organisation

Greenhouse gases

CFCs	Chloro fluoro carbons
CO	Carbon monoxide
CO ₂	Carbon dioxide
CH ₄	Methane
HFCs	Hydrofluorocarbons
H ₂ O	Water vapour

Terms

Adaptation	Adaptation refers to changes in technologies, practices and policies that can prepare a country for the impacts of climate change resulting from GHG emissions.
Bislama	A pidgin language with both English and French influences that has become the <i>lingua-franca</i> of ni-Vanuatu from different language groups.
CC:Train	Climate Change Training Programme setup by the United Nations Framework Convention on Climate Change
Custom	The traditional beliefs, values and common law that underpins the life of a ni-Vanuatu. Custom differs widely throughout Vanuatu and has evolved over millenia.
enteric fermentation	The digestive processes that take place inside cattle and other livestock that lead to the release of methane.
Subsistence agriculture	Small-scale cultivation of food crops primarily for household consumption and social exchange
Gardens	A plot of land on which food crops are cultivated for subsistence consumption, exchange, gifting or sale. Most households cultivate several gardens to meet their food needs.
Greenhouse Gas	A gas that is transparent to incoming solar radiation but capable of absorbing and re-emitting radiation in the infrared wavelengths.
GHG source	An activity or sector of the economy that releases emissions of GHG's.
Kava	A beverage prepared from the ground roots of <i>Piper methysticum</i> .
Plantations	Cleared land used for commercial agricultural activities. The term most commonly refers to coconut plantations, but is also used to refer to cattle pastures, either alone or in association with coconuts, and other cash crop regimes.
Sink	A system or part of the earth that acts as a reservoir for GHGs. Key sinks for carbon dioxide are the ocean and biomass (e.g. plants)
Vulnerability	The severity of impacts of climate changes on the natural environment, economic activities, human health and society.

1 INTRODUCTION

1.1 Background

During the 1980s there were growing international concerns that changes in the atmospheric concentrations of a number of gases had potential to affect world climate. In 1988 the United Nations General Assembly recognised the need to manage human activities that were affecting, or had potential to affect, the world's climate patterns. Following international negotiations the United Nations Framework Convention on Climate Change (UNFCCC) was opened for signature in 1992. Vanuatu was among the countries to sign the convention at its launch, and the Vanuatu parliament ratified the convention in 1993.

The objective of the UNFCCC treaty is to stabilise the concentrations of greenhouse gases in the atmosphere at levels that prevent dangerous interference with the world's climate. This should be done within a time frame that will allow ecosystems to adapt naturally to climate change, to ensure food production is not threatened and to enable economic development to proceed in a sustainable manner.

This national communication has been prepared to fulfill Vanuatu's obligations under Article's 4 and 12 of the UNFCCC. These require that all signatories to the UNFCCC communicate to the COP National Greenhouse Gas Inventories and develop national plans to mitigate climate change impacts and promote measures to facilitate adequate adaptation to climate change within 3 years of the convention coming into force. Due to limited national capacity and financial constraints Vanuatu has not been able to meet this requirement until now.

This communication has been prepared in accord with guidelines issued following the 2nd Conference of Parties to the treaty (COP2). It overviews national circumstances vis a vis climate change issues, presents a GHG inventory; analyses mitigation strategies, vulnerability and adaptation assessments and presents policy options. A number of project concepts are identified for further refinement and funding.

1.2 Process for development of this national communication

Vanuatu has been enabled to meet its national obligations under the UNFCCC through support received through the Pacific Islands Climate Change Assistance Programme (PICCAP). PICCAP is a three year programme funded by the Global Environment Facility (GEF), executed by the United Nations Development Program (UNDP) and implemented through the South Pacific Regional Environment Programme (SPREP), in close collaboration with the UNITAR administered CC:TRAIN.

The implementation of PICCAP in Vanuatu commenced with re-formation of the National Advisory Committee on Climate Change (NACCC) in 1997. The NACCC was first established in 1989 to advise the government on matters relating to climate change during the UNFCCC process and draws on expertise within key government departments. The committee facilitates the work of a technical team comprised of a National PICCAP Project Coordinator and technical staff drawn from relevant sectors to participate in the CC:TRAIN training programme. The project coordinator is based with the Vanuatu Meteorology Department.

Initial PICCAP activities focused on enhancing the understanding of climate change

issues and future scenarios by the NACCC members and key staff within national and provincial administrations. To encourage broader awareness of climate change issues a weekly 15-minute programme is prepared for national radio by the PICCAP project coordinator or other members of the technical team.

National Organisational Structure for Implementing Climate Change Activities.

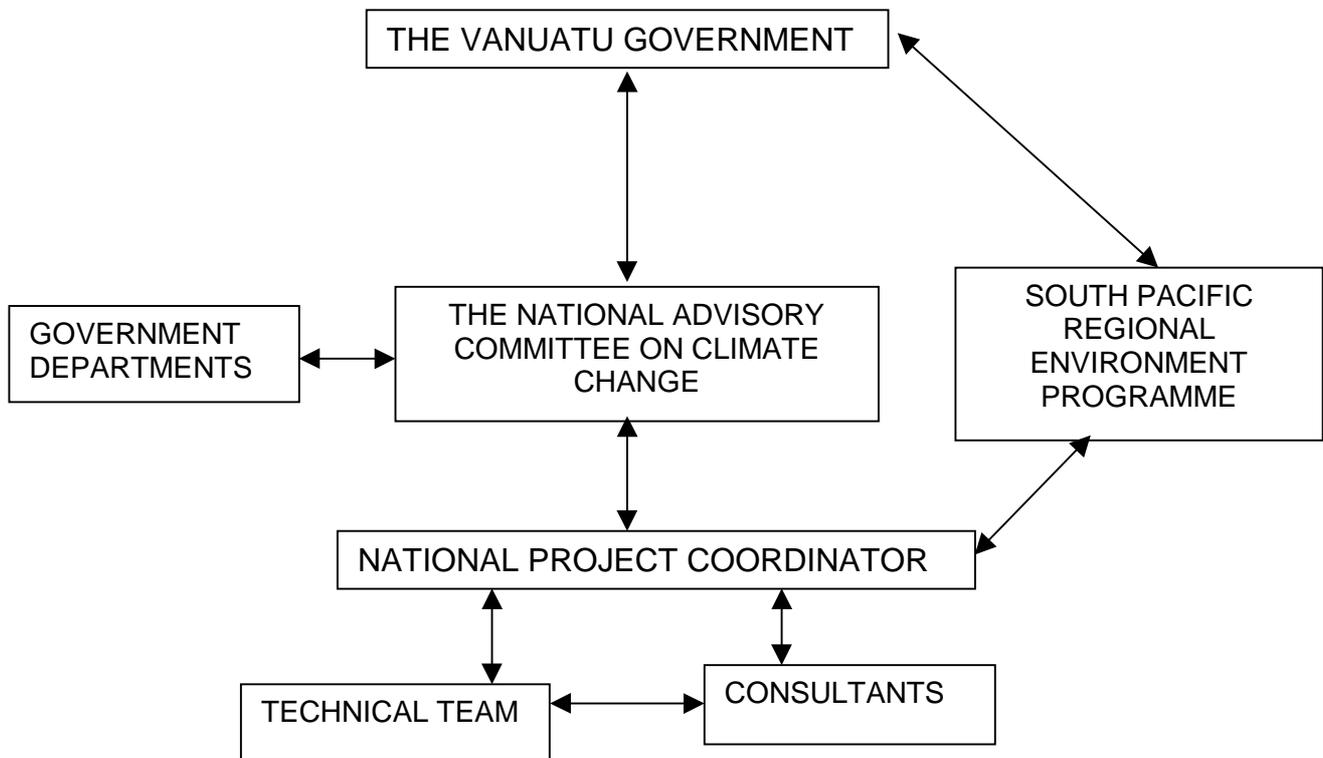


Fig. 1. Organisational structure for Vanuatu’s climate change project activities.

1.3 Base year

For the purposes of reporting and future monitoring the NACCC has set 1994 as the base year for the Greenhouse Gas Inventory and this national communication to the COP.

2 VANUATU'S CIRCUMSTANCES

2.1 Vanuatu

Vanuatu is an archipelago of over 80 islands stretching 1,300 kilometres from north to south in the Western Pacific Ocean. It has a combined land area of 12,190 square kilometres (Fig 1) and a maritime exclusive economic zone of 680,000 square kilometres.

The ancestors of indigenous ni-Vanuatu arrived in a series of migrations from the Northwest several thousand years ago. They settled throughout the archipelago practicing subsistence agriculture, hunting and gathering and a limited trade. Due to the difficult terrain and open seas between islands there was limited contact between settlements. There developed complex cultures and languages. This diversity through isolation is illustrated in Vanuatu having a high number of languages per capita: over 110 languages in use in a population in 1989 of 177,400 people (Statistics Office, 1997). These languages are the first and usually the preferred language of ni-Vanuatu. Bislama, a pidgin language based on English and French, developed to allow communication between ni-Vanuatu and European settlers, missionaries and traders. This is the common lingua-franca of ni-Vanuatu from different language groups. English and French are both used by government, business and education.

Of the estimated population of 177,400 people, 44,300 people live in the two urban areas: Port Vila, the capital city, with 33,700 people and Luganville with 10,600 people (Statistics Office, 1997, p.2). The remaining 70% of the population live in rural villages ranging from one family to several hundred people. Almost 80% of the population live on seven islands: Efate, where Port Vila is located; Santo, the largest island and where Luganville is located, Tanna, Malekula, Pentecost, Ambae and Ambrym.

From 1906 until 1980 Vanuatu was governed as a Condominium of both Britain and France. This arrangement led to a costly and at times confusing duplication of government and administrative services. It also led to competition between the two European nations as they sought to strengthen their individual interests and spheres of influence. Political independence was obtained in 1980. The legacies of the Condominium include expensive duplication of services in both English and French language mediums, and a social and political division between Francophones and Anglophones.

Travel and communications between and within islands is difficult and expensive. Within islands the rugged terrain and tropical forest isolate villages from each other. Telephone communications reach most larger islands, and many small ones. However there may be only 2 or 3 telephone sets on an island. Tele-radios are unreliable and there are at most only a few receivers on any island. Most rural villagers' only regular communication with outside areas comes as public radio broadcasts. The limited road networks are mainly on the lowland areas of larger islands, as the highly dissected terrain of inland areas creates problems for road construction. Coastal shipping services the central islands regularly, but the outer islands very irregularly. Vanair provides daily passenger and cargo flights between Efate, Tanna, Malekula and Santo, in 18 seater planes, but many smaller or more remote islands are served only 2 or 3 flights per week. Smaller islands may not have airstrips.

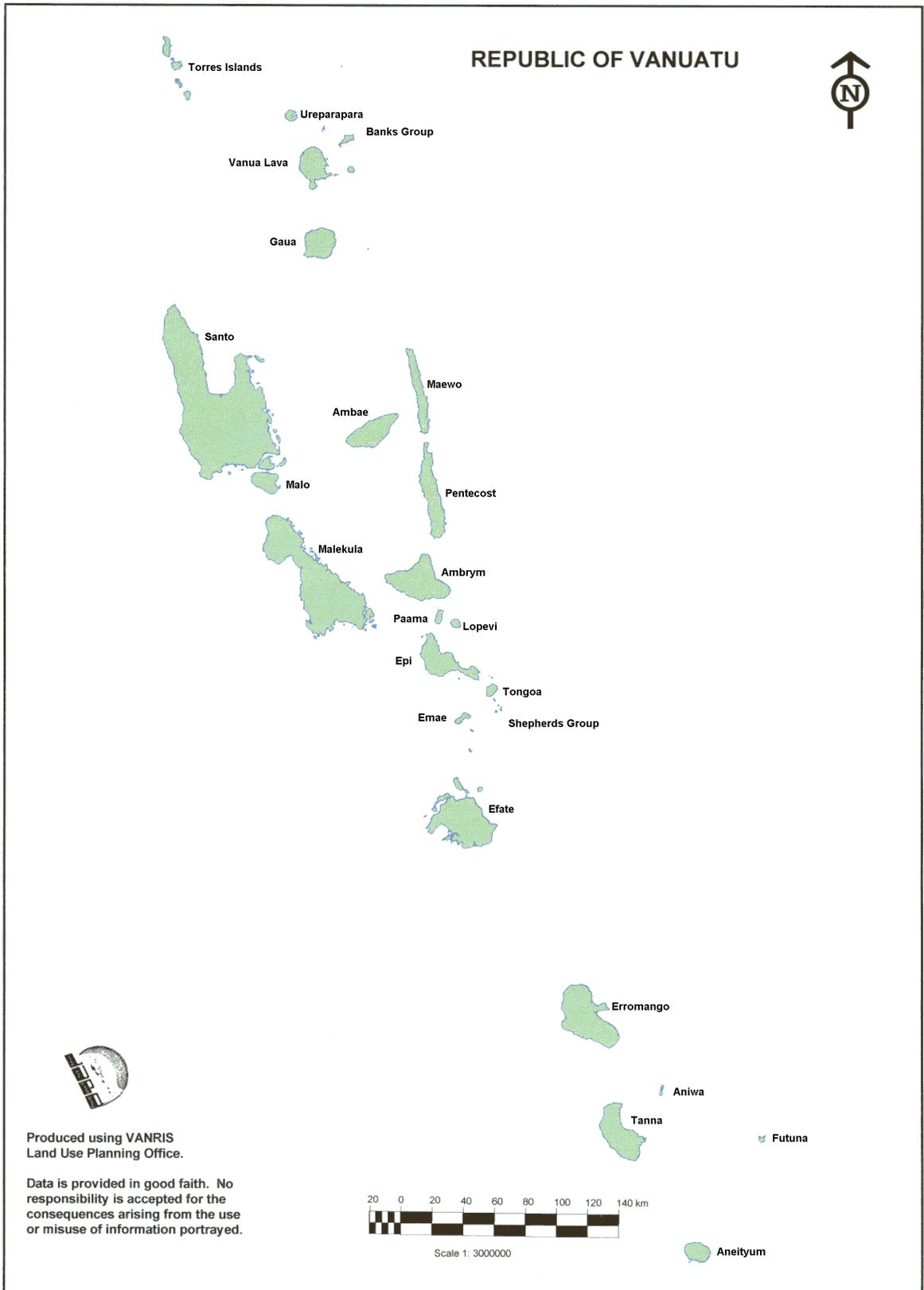


Figure 2.1: Principal Islands of Vanuatu.

2.2 Vanuatu's economic and social structure

Two economic systems operate side by side in Vanuatu: the subsistence economy and the cash economy.

Over 70% of the population live on their traditional lands, growing food crops and harvesting forest and marine resources for personal consumption, exchange and gifting. All the necessities of life are available locally. Rural villagers' participation in the cash economy is a minor component of their economic activity. They do, however, earn cash income from marketing copra, cocoa, other cash crops, shells and handicrafts, or by granting a logging company access to their timber. Cash income is primarily directed to school fees, transport to school and purchases of household items and other material wants. The subsistence economy operates independently of the cash and international economy. There is a gradual merging of the two economies as interest grows in small-holder business activities, most notably in transport, agriculture, livestock and tourism.

Source: Statistics Office, 1997.

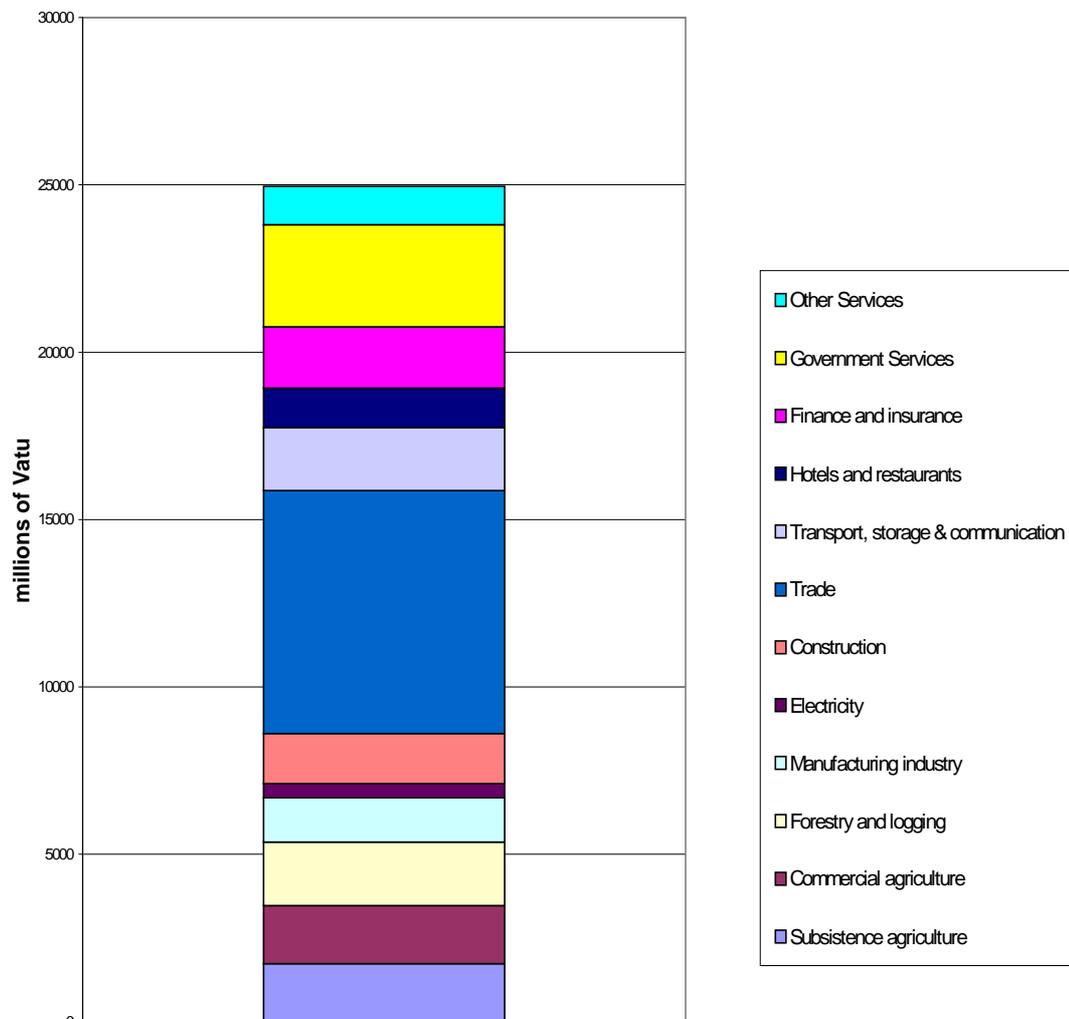


Fig 2.2 : Contribution of different sectors to GDP, 1994.

The cash economy is centered on the two urban areas: Port Vila and Luganville. It is dominated by services and a limited range of agricultural commodities (Fig 2.2). The services sector includes government services, an off-shore finance centre, and tourism. Although the agricultural sector contributes less to GDP than services, it is the principal economic activity and source of income for the majority of people and makes the largest contribution to domestic exports. The industrial sector is small (Fig 2.3). Its contribution to GDP rose steadily from 8% of GDP in 1983 to over 13% in early 1995 but has since stabilised. The country is reliant on imported manufactured goods and fuels.

Table 2.3 : The formal industrial sector, 1995.

Source: Department of Industries and Trade Statistics.

Industry	No of firms	Number of people employed
Food, beverage and tobacco	18	564
Textile, Clothing and Leather	12	77
Wood and wood products	17	465
Paper, paper products & printing	5	56
Chemical, rubber and plastic	8	68
Basic metal	2	11
Fabricated metal products	8	161
Miscellaneous	8	69

Growth in GDP averaged 2.8 % per annum, over the 5 years from 1991 to 1996 (Statistics Office, 1998, p.4). Yet with a population growth of 2.8%, per capita gross domestic product has remained steady. In 1983 the per capita income of ni-Vanuatu was 38,500 Vatu, which by 1989 had fallen to about 37,000 Vatu in real terms¹. Per capita urban income is on average 8.5% higher than per capita rural income.

The narrowness of the country's economic base and the small local market makes Vanuatu's cash economy particularly vulnerable to external influences such as world commodity downturns or fluctuations in tourism. The value of imports exceeds export earnings. Further economic development of the cash economy is constrained by

- distance from international markets,
- the country's limited natural resource base,
- the high costs of infrastructure and energy,
- the limited and unstructured internal market and
- damage to crops and infrastructure by cyclones, earthquakes and volcanic eruptions.

¹ 37,000 Vatu is approximately USD\$300 at current exchange rates.

Table 2.1 Summary of National Circumstances

Population (1994 estimate)	164,200 people
% of population urban (1996 estimate)	23.4%
% of population under 15 at 1989 census	44.4%
Land Area	12,270 km ²
Exclusive Economic Zone	680,000 km ²
Gross Domestic Product (1994)	24,962 million Vatu
GDP per capita (1994)	152,000 Vatu
Primary Industry in GDP (1994)	5,372 million Vatu (21.5%)
Industry in GDP (1994)	3,237 million Vatu (13%)
Services in GDP (1994)	16,353 million Vatu (65.5%)
Percent of total population employed in primary industries (1989)	35%
Percent of total population employed in manufacturing (1989)	0.6%
Percent of population employed in community, social and business services (1989)	6%
Land area used intensively	2,870 Km ²
Land area under forest	4,380 Km ²
Percent of population over 6 who had or were attending school (1989)	81%
Percent of population over 6 with a Primary Leaving Certificate (1989)	34%
No: of ni-Vanuatu with a tertiary qualification (1989)	541
US Dollar exchange rate used by Department of Customs	0.88

2.3 Review of Government programmes

Since ratifying the UNFCCC Vanuatu has participated in a number of regional programmes and introduced national policy initiatives that demonstrate its commitment to meeting its responsibilities under the Convention. These include:

- State of the Environment Reporting Programme. A SPREP sponsored initiative to establish a database of relevant environmental criteria for on-going assessment of the state of Vanuatu's environment.
- Vanuatu Sustainable Forestry Utilisation Project and the South Pacific German Forestry Programme. Two project's that are strengthening national capacity to improve forest management. More sustainable logging systems will maintain forest cover and hence minimise carbon loss.
- Pacific Regional Agricultural Programme that is studying and promoting sustainable agricultural systems, reducing the rate of conversion of forests to agriculture.

3 NATIONAL GREENHOUSE GAS INVENTORY

As a signatory to the UNFCCC, Vanuatu is required to report periodically on the country's emissions of Greenhouse Gases, and programmes in place or planned to reduce these emissions. Data in this summary is drawn from an inventory of GHG emissions calculated for 1994 prepared for the NACCC by Nathaniel Bue and Ione Viji. The figures represent a minimum level of emissions because there was very limited data available on activities such as fuel-wood consumption, burning of land for gardening and farming, forest conversion, planting, etc. which may be nationally significant greenhouse gas sources and sinks.

It is noted that Vanuatu also has significant natural sources and sinks of greenhouse gases including volcanoes, sulpharoles, steam vents, and marine algae and the roles of these in the greenhouse effect are not well understood.

3.1 What are Greenhouse Gases

Energy from the sun enters the earth's atmosphere and falls on the land, sea and ice caps: about 20% is re-radiated back into space. The rest is absorbed by the earth's surface and then released back into the atmosphere as long wave infra red radiation. A number of naturally occurring gases absorb out-going infra red radiation, preventing it escaping into space, and trapping it in the earth's lower atmosphere. Without this natural effect the earth would be too cold to sustain life. These gases have become known as "greenhouse gases" (Fig 3.1), and their ability to maintain warm temperatures on the earth's surface is known as the "greenhouse effect".

The concentration of natural greenhouse gases has increased significantly over the past 300 years as a result of additional man-made sources. At the same time concentrations of a number of man-made gases that have a similar affect, or that indirectly enhance the greenhouse effect, have also increased. It is feared that the increase in natural and man-made greenhouse gases may alter the existing global energy balance and impact on the world's climate. It is generally accepted that this may lead to net global warming and sea level rise although the exact climatic changes that will occur in different parts of the world are not well understood.

The purpose of the UNFCCC is to stabilise concentrations of greenhouse gases in the atmosphere at levels that prevent dangerous interference with the world's climate. The first step to managing GHG emissions is to understand the different sources of emissions and the volumes of GHGs released. This is the purpose of preparing an inventory of man made greenhouse gas emissions.

Table 3.1 Common greenhouse gases

Naturally occurring GHGs	Natural sources of GHGs	Man-made sources of GHGs
Water vapour (H ₂ O) Carbon dioxide (CO ₂) Methane (CH ₄) Nitrous oxide (NO) Ozone (O ₃)	<ul style="list-style-type: none"> ◆ Respiration of plants and animals ◆ Combustion / fire ◆ Volcanoes ◆ Sulpharoles & steam vents ◆ Evaporation 	<ul style="list-style-type: none"> ◆ Burning of fuels (wood, gas, petroleum products etc.) ◆ Livestock ◆ Burning to clear land
Man-made Greenhouse Gases		
Chlorofluorocarbons (CFCs) Hydrofluorocarbons (HFCs) Perfluorinated carbon compounds (PFCs) Carbon monoxide (CO) Oxides of Nitrogen (NO _x) Non-methane volatile organic compounds (NMVOC)		<ul style="list-style-type: none"> ◆ Produced for propellants in pressure packs (CFCs no longer in use for this purpose) ◆ Refrigeration ◆ Fire extinguishers ◆ Cleaning solvents ◆ Incomplete combustion of fuels ◆ Pollution from industrial processes

The IPCC guidelines for preparation of a GHG inventory organise man-made GHG emissions into 6 groups:

1. Energy activities (Combustion of fuels for energy & transport, Industry and manufacturing and other sectors)
2. Industrial processes
3. Solvent and other product use
4. Agriculture (Enteric fermentation, manure management & soils)
5. Land use change and forestry (Clearing, managed lands, conversion to agriculture)
6. Waste (solid waste disposal on land and waste water handling)

This structure is used in the following discussion.

3.2 Method for preparation of Vanuatu's GHG Inventory

The Vanuatu assessment of GHG emissions employs IPCC 1996 guidelines and the relevant OECD and IEA guidelines. In all cases the IPCC guidelines default emission factors and conversion coefficients are used.

The inventory focuses on energy, agriculture, land-use and forestry sectors. This decision reflects the small volume of solvent and other product use in Vanuatu; the small size of Vanuatu's industrial sector; the lack of information about GHG generation from these sectors; unreliable reporting formats; the lack of previous work to characterise waste generation; and the relative quantity of GHG emitted by various sectors and the global warming potential of gases produced.

Despite limiting the GHG inventory to these 3 sectors uncertainties and discrepancies in the data are significant. For example livestock were well documented while other GHG emitting activities of the agricultural sector, such as land clearance, burning and fuel wood consumption for drying of commercial agricultural produce were not documented.

3.3 National GHG Inventory

Table 3.2 summarises the volumes of GHGs identified by the National GHG Inventory. These emission volumes are low on a global scale: both in terms of total emissions and emissions per capita.

Table 3.2: 1994 GHG inventory summary.

(data presented in gigagrams (Gg))

Greenhouse gas sources or sink categories	CO ₂ Emissions	CO ₂ Removals	CH ₄	N ₂ O	NO _x	CO
Total Emissions and Removals	56.7078	-1.1534	11.1996	0.0291	0.1369	0.0143
Energy	55.1532		0.0026	0.0291	0.0832	0.0195
Industrial Processes	nr		nr			
Solvents and other Product Use	nr		nr			
Agriculture	nr	nr	11.1981			
Land Use and Forestry	net	-1.1534				
Waste	nr		nr			
International Bunkers Total	4.6001		0.0001	0.0031	0.0102	0.0011
Note: net: emissions netted into removals nr: not recorded						

3.3.1 The energy sector

The 1994 GHG inventory considers only those GHG emissions coming from the use of imported petroleum products. Fuel wood, the principal source of energy for rural households and an important fuel for production of dried/smoked agricultural produce is not included. Also excluded is charcoal, a minor fuel in rural areas. There are inadequate statistics presently available about these fuels to include them in inventory calculations.

Even with these exclusions the energy sector is the largest contributor to the Vanuatu GHG emissions total. Carbon dioxide is the most significant gas emitted by this sector with other gases contributing less than 1.5% of emissions by weight.

In accord with IPCC guidelines the inventory cross-checked CO₂ emissions from the energy sector calculated using sectoral data with a reference calculation based on the tonnes of fuel imported into Vanuatu². There is a difference between the two calculation methods of 2.74%. This difference may indicate discrepancies in the quality of data on which the calculations are based or that almost 3% of emissions have not been accounted for.

Table 3.3 Energy sector GHG emissions (Gg)

Greenhouse gas sources or sink categories	CO ₂	CH ₄	N ₂ O	NO _x	CO
Total Emissions and Removals	55.1531762	0.00255291	0.02909677	0.08323090	0.01946858
A Fuel Combustion Activities	55.1531762	0.00255291	0.02909677	0.08323090	0.01946858
1. Energy Industries (public electricity)	12.6736546	0.00100338	0	0.5570475	0.00518988
2. Manufacturing industries & construction	0.9288911	0.00007087	0	0.00393431	0.00036655
3. Transport	36.7776918	0.00109306	0.02739289	0.12148739	0.01226668
4. Other sectors (commercial, residential, agricultural/Forest/Fishing)	4.77293865	0.00038261	0.00170388	0.01144310	0.00164547
B Fugitive emissions from fuels	0	0	0	0	0
C International bunkers (not in national totals)	4.60025329	0.00010503	0.00305252	0.01017506	0.00111597

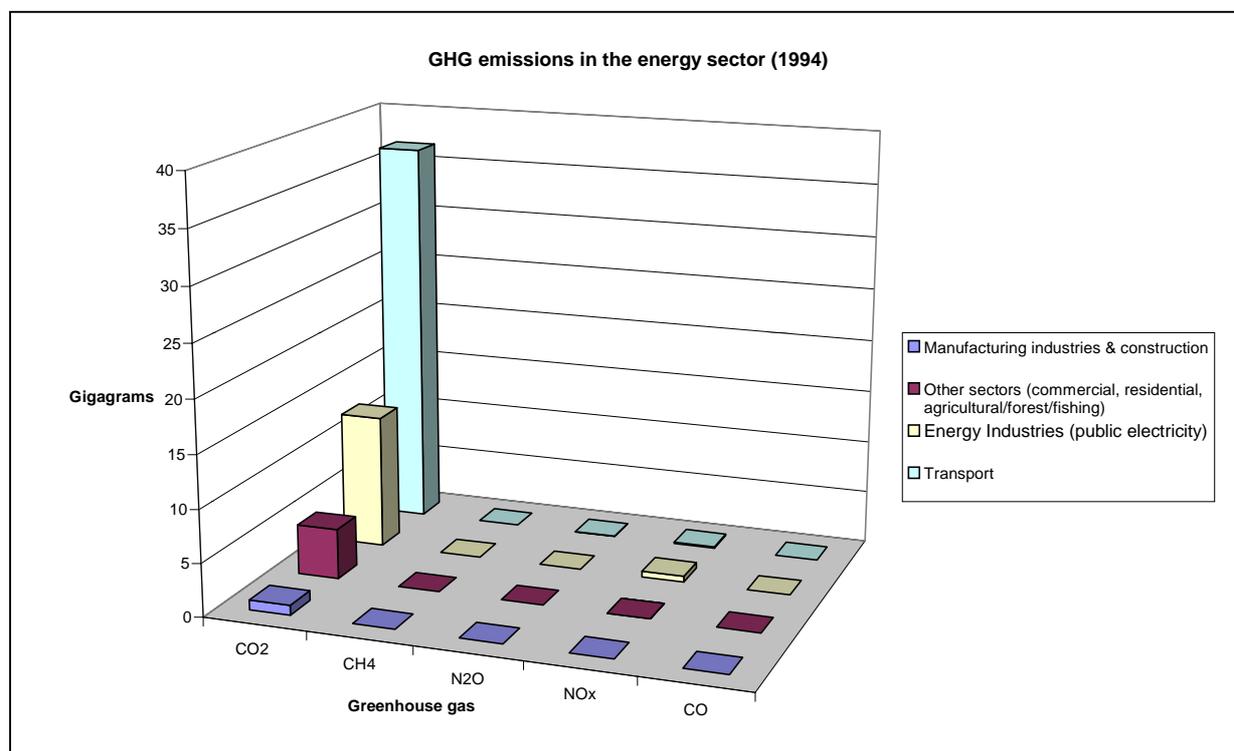


Fig 3.1 Energy sector GHG emissions (Gg)

The significance of different fuels is indicated by Fig 3.3. Understanding of the

² No petroleum products are produced in country.

contribution of different sectors and different fuel types helps to ensure mitigation measures are appropriately targeted. It can be seen that the transport sector utilises 55% of fuel imports but generates 66% of carbon dioxide emissions.

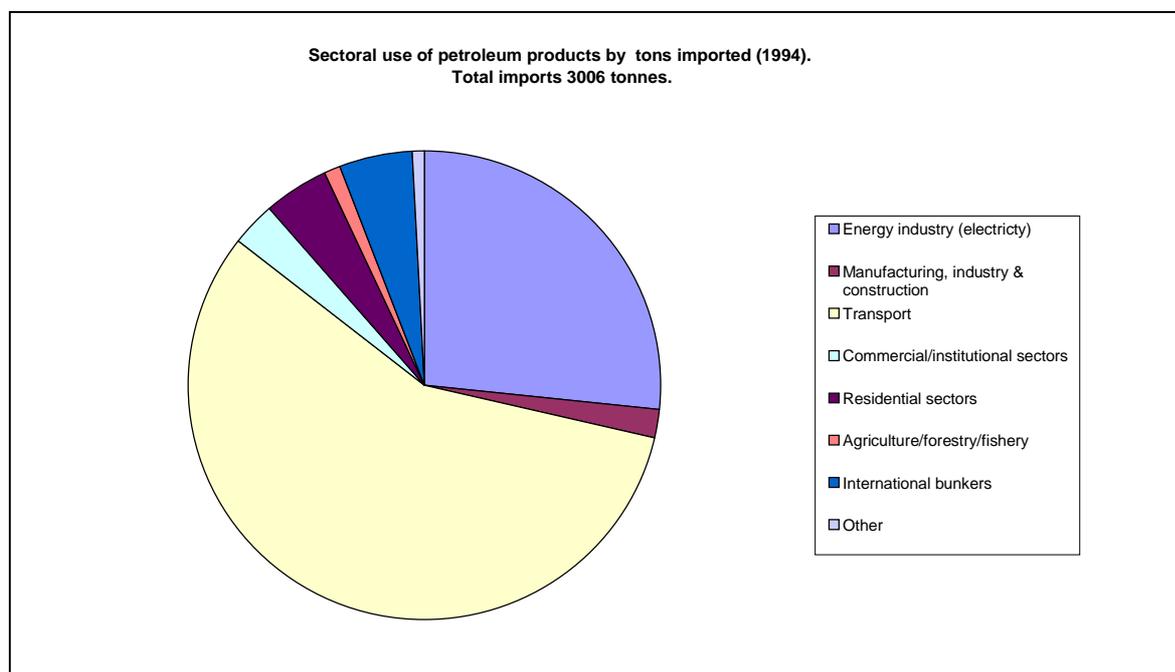


Fig. 3.2 Sectoral use of imported petroleum products.

3.3.2 Industrial processes and solvent and other product use

In Vanuatu these two GHG sectors are small, and there is limited data available on their activities. They have been excluded from this initial GHG inventory

3.3.3 Agriculture sector

This GHG inventory only considers emissions of CH₄ from the enteric fermentation and manure of domestic livestock. Other categories nominated by the IPCC in this sector have not been reported. Rice cultivation and waste management systems such as the use of anaerobic lagoons, solid storage and liquid systems are not practiced in Vanuatu. All animal manure is left in the paddock where it is deposited. The burning of agricultural waste and burning of grassland areas are not reported as there is no appropriate data quantifying these activities. An assessment of GHG emissions from such activities has been commissioned and will be available for incorporation into future GHG inventories.

Calculations based on livestock numbers estimated 11.198125 gigagrams emissions of methane from domestic livestock in 1994.

3.3.4 Land use change and forestry emissions

No statistics have been kept on the burning of forest and grassland, forest and grassland conversion and the abandonment of managed lands and the national GIS has only recently updated to 1992 satellite imagery. These activities may be significant given the historic dominance of shifting cultivation and the expansion of

commercial agriculture in recent years. However, without additional investment in data collection they cannot be quantified.

Consequently only activities associated with commercial forestry and commercial plantations were considered in the 1994 GHG inventory. This data led to estimates of a net annual release from wood biomass removals of *Pinus Caribaea* and mixed hardwood of -1.15335 gigagrams of CO₂. So forest activities in Vanuatu provide a sink for CO₂ emissions.

3.3.5 Fugitive Emissions

The IPCC guidelines require the reporting of fugitive emissions (emissions resulting from activities associated with mining, processing, handling and storage of coal). Vanuatu is not engaged in activities relating to this GHG emissions category.

3.3.6 Bunker Fuels

Bunker fuel data applies to fuels for aircraft only as there are no refueling facilities for international marine transport. The total quantity of jet kerosene imported in 1994 was 4.63 x 10³ tonnes. Approximately 31.8% were used for international aviation while the remaining 68% were used domestically. The total CO₂ emission from Bunker Fuels is 4.60025 gigagrams. This is not included in the national emissions totals.

3.3.7 Emissions from waste (solid waste disposal on land and waste water handling)

Methane is formed during the anaerobic decomposition of organic wastes in landfills and sewage treatment works and these sources can make a significant contribution to GHG emissions. At present the only closed landfill in Vanuatu is operated by the Port Vila Municipality. Elsewhere solid wastes are dumped in open disposal sites and/or burnt. With the exception of resorts and the hospital sewage, wastes are treated in septic tanks and disposed of on site. The resorts and hospital operate small package treatment plants, but process a minor amount of the human waste produced nationally. Hence no calculations of methane emissions from the waste sector have been made.

3.4 Projections

The data on which the 1994 GHG inventory is based, in particular the omission of emission sources due to lack of statistical data and the error margins within the data provided, it is premature to prepare long term projections for Vanuatu's national GHG emissions.

An important consideration for future GHG emissions is the Government's commitment to improve the well being of ni-Vanuatu through improvements in water supply, electricity and transport. It is consequent that this will lead to an increase in GHG emissions per capita until economic and practical alternatives to fossil fuels for the transport and energy sector can be introduced. At present fossil fuels are the only practical alternatives available in Vanuatu, especially for the transport sector and most electricity generation. Vanuatu will look to the more developed countries to take a lead in developing, producing and introducing cost effective alternatives.

3.5 Remarks

There are significant gaps in Vanuatu's first GHG inventory due to the lack of relevant statistical data that can be fed into calculation models. Refinements of the quoted emission estimates will require data collection to characterise the use of fire wood; burning of forest, scrub and grassland within subsistence and commercial agriculture, to improve hunting and accessibility; non-commercial forest activities; conversion of land use; waste inventories; and emissions from industry and manufacturing.

Never the less it is reasonable to conclude that the energy sector is the major source of GHG emissions in Vanuatu, with emissions dominated by the transport and energy industries. Any efforts to significantly mitigate GHG emissions will appropriately target emissions from these activities. Yet given the national need for human and social development, and the small proportion of the population with good access to transport and energy services at present, emissions are likely to continue to increase for the next decade.

4 VULNERABILITY

A country's **vulnerability** refers to the severity of impacts of climate changes on the natural environment, economic activities, human health and society. The purpose of reporting on national vulnerability is to:

1. present a concise summary of what is known about the possible effects of climate and sea-level change, possible adaptation to these effects and the resultant vulnerabilities in Vanuatu.
2. identify gaps in knowledge in determining climate and sea-level change effects, adaptation options and vulnerability.
3. identify national needs and priorities to prepare for climate and sea-level change.

4.1 Climate scenarios

Climatic scenarios for Vanuatu have been modeled on the SCENGEN scenario generator with two Global Circulation Models: HADCM2 and CSIRO9M2. The climate scenarios depicted are described below. The results for temperature and rainfall are summarised in tables 4.1, 4.2 and 4.3. These results are compared with analogue predictions based on observation of past trends presented in figs 4.1 to 4.5.

The two computer models predict increases in temperature of between one and two degrees up to the year 2050. However they present quite different scenarios with respect to rainfall. The accepted IPCC fair estimate for sea level increase is 50cm over the next 100 years.

There is limited historic climatic data for Vanuatu with records back to 1949 for Efate and 1973 for Luganville, the country's 2 urban centres. Trends suggest a gradual increase in temperature that is more marked in the south. Records from both centres suggest a gradual decline in rainfall. There has also been a significant increase in the frequency of tropical cyclones in the country as a whole over the record period, although this trend could be influenced by improved recording of such events since the introduction of satellite tracking technology.

Tectonic uplift is well documented in many areas of the country, while a few islands demonstrate subsidence. Active volcanism also impact on a number of islands. Because of the extent of tectonic activity affecting Vanuatu it is difficult to attribute apparent changes in sea level to the effects of climate change. However for much of the country it is assumed that tectonic uplift of islands will proceed at a greater rate than sea level rise. Never-the less there are concerns that sea level rise might have locally severe impacts in the Torres Group, Aneityum, East Ambae, Shepherds Islands and the two towns of Port Vila and Luganville.

On the basis of climate scenario modeling and historical records it is reasonable to assume that climate change over the next century will lead to warmer and drier conditions in much of Vanuatu with the size of the change increasing away from the equator. However the possibility of increased rainfall should not be dismissed. These effects will be accentuated by more frequent and severe cyclone events. Heavy rainfall is a normal component of cyclonic storms so a greater proportion of rain will be associated with the passage of storms. The HADCM2 model indicates there may be more frequent El Nino type conditions: these conditions are associated with prolonged dry seasons.

Scenarios predicted by the SCENGEN generator.

Table 4.1 Temperature scenario.

T E M P E R A T U R E		
SCENARIO	2050	2100
CSIRO9M2		
IS92a(mid)	0.9 °C	1.5 °C
IS92e(high)	1.5 °C	3.0 °C
HADCM2		
IS92a(mid)	1.4 °C	2.4 °C
IS92e(high)	2.2 °C	4.5 °C

Table 4.2 Precipitation scenario.

P R E C I P I T A T I O N		
SCENARIO	2050	2100
CSIRO9M2		
IS92a(mid)	7.4 %	13.5 %
IS92e(high)	12.1%	25.2 %
HADCM2		
IS92a(mid)	-6.8 %	-11.8 %
IS92e(high)	-10.6 %	-22.0 %

Table 4.3 Sea Level Rise Scenario.

S E A L E V E L R I S E		
	2050	2100
IS92a (Mid)	19.8 cm	48.9 cm
IS92e (High)	39.7 cm	94.1 cm

Historical climate trends – temperature

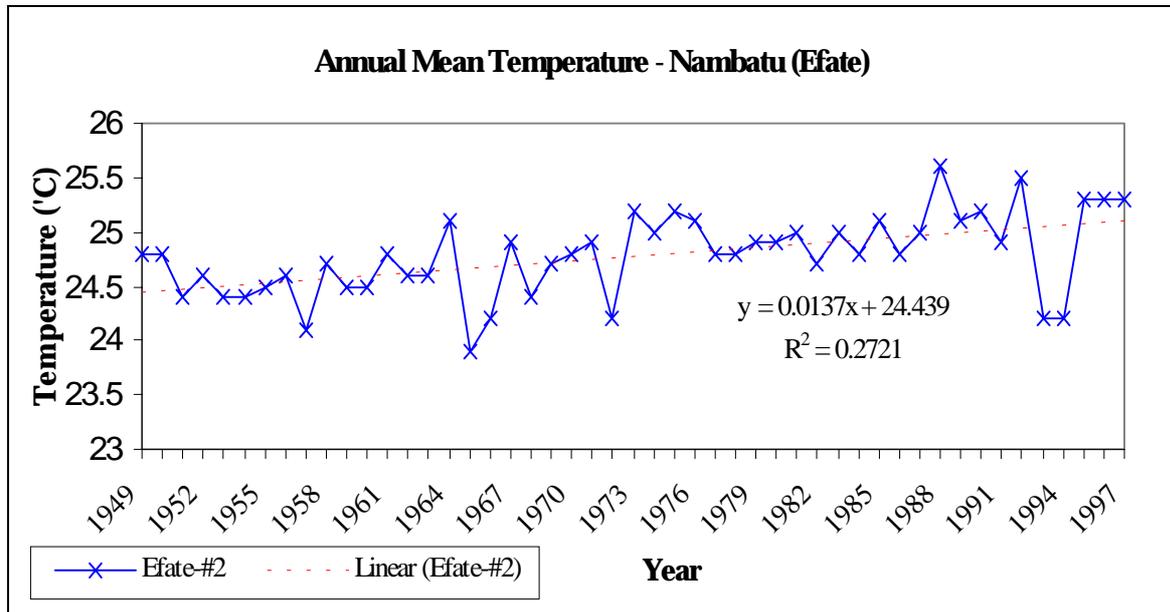


Figure 4.1 Efate Annual Mean Temperature

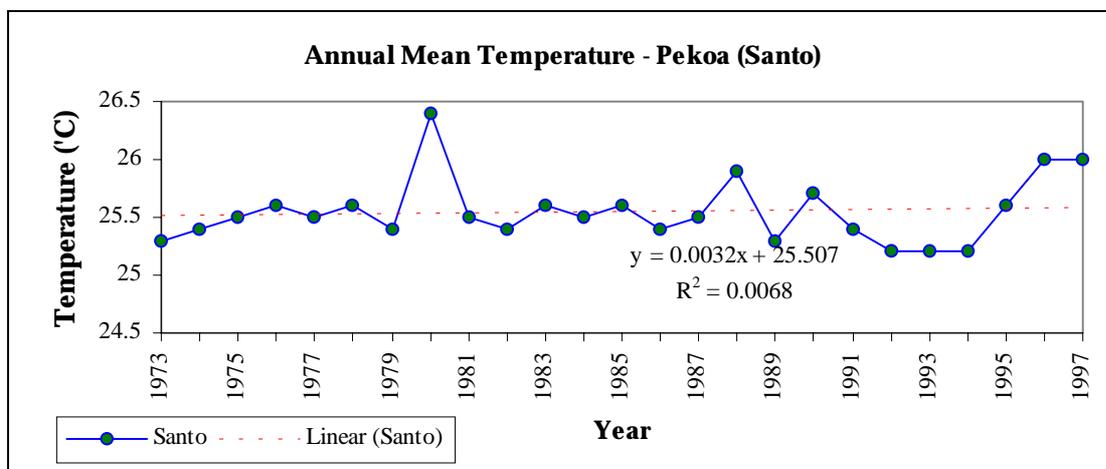


Figure 4.2. Santo – Annual Mean Temperature

Historical climate trends - Rainfall

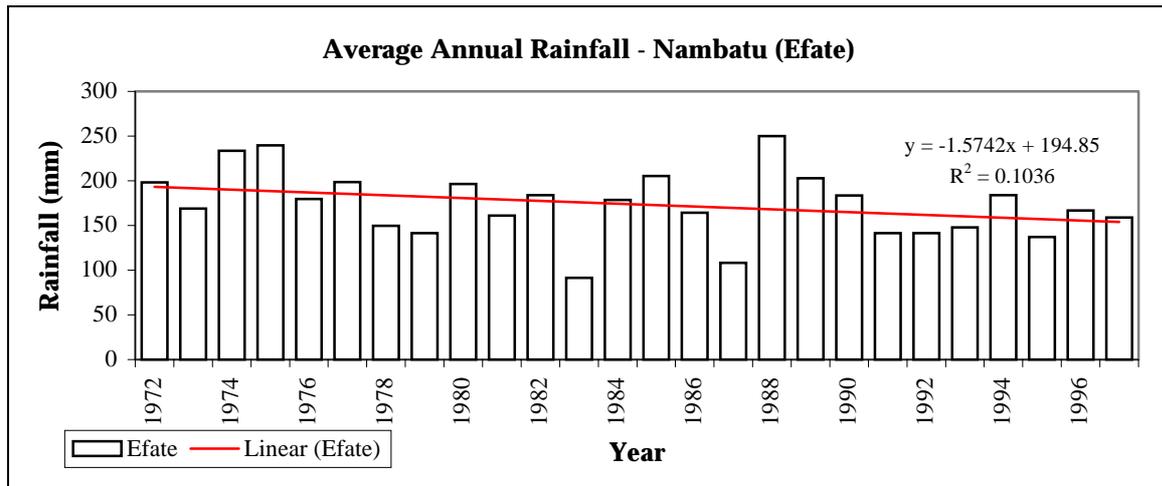


Figure 4.3. Efate – Average Annual Rainfall

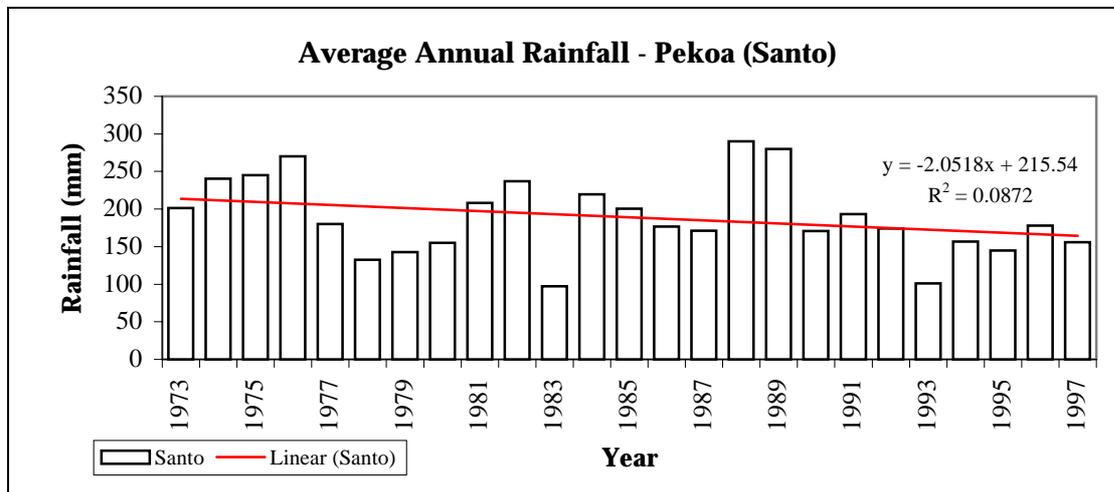


Figure 4.4 Santo – Average Annual Rainfall

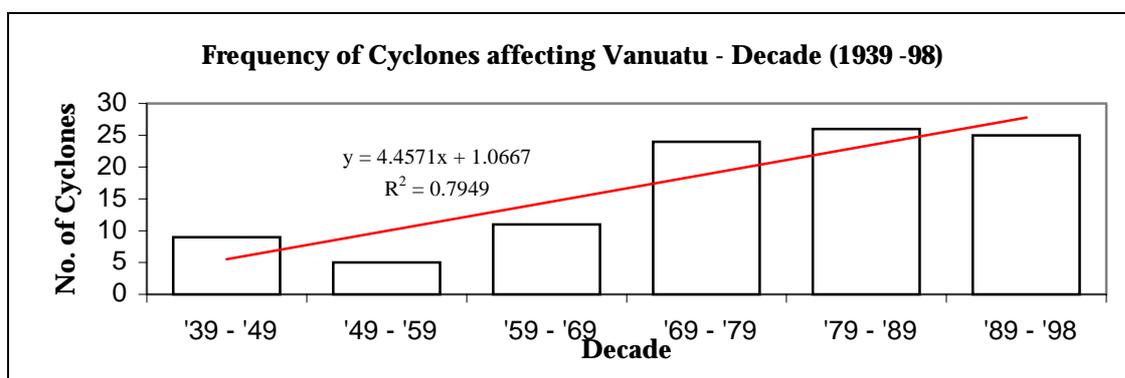


Figure 4.5 Vanuatu's cyclone frequency

4.2 The likely impacts of predicted climate change scenarios

4.2.1 Agriculture

The impacts of climate change and increased carbon dioxide concentrations on plant growth, productivity and the nutrient value of crops commonly grown in Vanuatu is not understood. However, general knowledge of possible impacts suggest changes may be detrimental to agricultural production and hence national food security.

In many instances it is believed the increased carbon dioxide concentrations in the atmosphere and warmer temperatures will promote rapid growth of green matter rather than crops. Crop growth seasons are likely to change, and this might affect seasonal food security. Pastures may support fewer animals as the more rapid growth expected may lead to grasses of less nutritive value than at present.

Both commercial and subsistence agriculture are based on rain-fed agricultural production systems. Changes in rainfall, and in particular the projected scenario of overall rainfall decline, a greater proportion of rain falling in association with high intensity storm events during the wet season, increased evaporation and more pronounced dry seasons, could have severe impacts on agricultural production. Intense rainfall in planting seasons could damage seedlings, reduce growth and provide conditions that promote plant pests and diseases. More pronounced dry seasons, warmer temperatures and greater evaporation could stress plants reducing productivity and harvests.

The alternate scenario of increased rainfall could have equally severe impacts: with water logged soils decreasing agricultural production, while increased humidity and rainfall will provide ideal conditions for proliferation of a number of plant pathogens.

Any decrease in agricultural production would adversely affect both the nation's economy and food security. However, current modeling is insufficient to measure the consequences of declining productivity on the national economy or to highlight islands of particular concern.

4.2.2 Human health

There is a high incidence of mosquito borne diseases in Vanuatu, which reduce the productive capacity of human resources. Both climate change scenarios provide conditions that would sustain breeding sites for mosquitoes, and potentially extend breeding seasons. This could increase the incidence of disease, with malaria, dengue and filiarisis of particular concern.

Higher intensity rainfall associated with increased cyclone incidence also creates conditions that foster the spread of communicable and water borne diseases, and may create a need for additional (and expensive) treatment of household water supplies.

An increase in temperature will generally increase human discomfort and can lead to increased morbidity.

4.2.3 Water resources

Vanuatu has limited surface water and villagers on many islands and residents of both urban areas are dependent of ground water. Increased temperatures are likely to increase the demand for potable water. However increased heat, greater run-off from high intensity rainfall events, decreased rainfall and an associated increase in evaporation could reduce the rate of ground water recharge and decrease surface water flows. Water shortages already apparent in dry seasons would become more pronounced and may require more sophisticated water distribution networks to maintain human populations in severely affected areas.

Higher intensity rainfall events could increase turbidity in surface waters decreasing their suitability for domestic purposes.

Any increase in sea level could cause salt-water intrusion into the shallow ground water lens in coastal areas, particularly if ground water recharge was reduced or water over-extracted. This affect would be most problematic in small low-lying islands that are dependent on shallow ground water aquifers.

4.2.4 Coastal environment

National investments in infrastructure and agriculture are primarily in low lying coastal areas around the perimeter of the major islands. The commercial centres of both Luganville and Port Vila in particular are both built on land only a few metres above sea level. The infrastructure and fixed assets of both centres are vulnerable to cyclone damage and associated storm surges, and may be affected by quite small increases in sea level or increased frequency and intensity of tropical cyclones.

Human activities in the coastal environment, including sand extraction and mangrove removal has increased the sensitivity of these important coastal buffers to climate and sea level variations. These activities may compound the affects of sea level rise.

A map of coastal areas less than 3 metres above sea level was not available for this report but can be determined using data held in the Lands Survey Department. Localised areas thought to be of particular concern include:

- ◆ the low-lying islands of the Torres Group of Islands;
- ◆ areas such as Mele on Efate island where sand extraction from coastal dunes and development pressures has increased the potential for impacts through coastal erosion;
- ◆ areas such as east-Ambae where localised subsidence has led to salt water flooding of low-lying coconut plantations;
- ◆ Areas already experiencing coastal erosion such as the Shepherds Islands.

4.2.5 Coral reefs

Coral reef systems fringe most islands in Vanuatu. They are important sources of economic and subsistence resources, and a draw-card for the important tourism sector, while protecting adjacent coastlines from extreme sea events.

Reefs are highly vulnerable to the climate change scenarios predicted. More frequent and higher intensity cyclones will cause physical disturbance to reef systems. Meanwhile coral death and bleaching is caused by increased atmospheric

concentrations of carbon dioxide and raised sea-surface temperature. Coral morbidity is associated with a decline in productivity of associated fish species, and increased incidence of ciguatera. Both effects would impact on human well being in coastal areas.

4.2.6 Mangroves, sea grass beds and other near-shore marine ecosystems

Tectonic uplift currently limits the growth of mangrove forests in many areas, as most species present are adapted to a narrow range of environmental conditions. Dead mature mangrove trees can be observed on the land-ward edge of mangrove stands, in areas no longer adequately submerged for their survival. Sea level rise may help mangroves become more stable communities. However negative impacts from more frequent storm surges, decreased salinity during high intensity rainfall events and increased coastal erosion are considered more likely.

Similar impacts are envisaged for sea grass meadows and other near-shore marine ecosystems.

4.2.7 Fisheries

The impacts of climate change scenarios on marine fisheries is poorly understood. A range of impacts may be expected. Any rise in sea surface temperature is likely to decrease the amount of available oxygen, increase the growth of aquatic plants and increase the metabolic rates of organisms. The decrease in available oxygen is likely to reduce growth, lower survival rates and increase fish mortality. Changes in sea temperatures will lead to changes in wind and ocean circulation patterns that may impact on the distribution and availability of nutrients and change patterns of migratory and non-migratory fish stocks. Greater extremes of weather may reduce opportunities for fishing during some seasons. Greater extremes of weather may also affect transport services between islands reducing opportunities to market produce.

4.2.8 Socio-economic issues

While there is inadequate climate and economic data to quantify the socioeconomic impacts of climate change the physical effects described above raise a number of concerns:

- ◆ Food security

Vanuatu's high rate of population growth is increasing demand for both subsistence and commercial agricultural production. Climate change impacts on crop growth and productivity could have locally severe implications for food security and human nutrition and health. It will also affect Vanuatu's agriculture based export earnings.

- ◆ Water shortages

Population growth, particularly in urban areas, has already placed pressure on water resources and supply services. Climate change is likely to increase demand for water and yet reduce the quality and affect water sources. This has implications for water source management, the development of human populations and human health and wellbeing. It must also be considered in planning for industrial development, as most industrial activities are heavy water

users.

◆ Public health

Projected climate change scenarios are likely to lead to increases in a number of tropical and vector borne diseases, and increased health problems through contamination and deterioration in water quality. Health services are already a major expense item for government.

◆ Damage to public infrastructure and fixed assets

Replacement and maintenance of public infrastructure and fixed assets in coastal areas could become a costly burden to Vanuatu's small economy and a hindrance to social development.

◆ Cultural concerns

Ni-Vanuatu society and culture is based on a complex environmental and social inter-relationship. Changes to this traditional social system, coupled with any decrease in food security and water availability, could lead to deterioration of social systems and law and order.

◆ Negative economic impacts

The affects of climate change on agriculture production, human health and well being will have the consequences of decreasing national income while increasing key social and infrastructure costs. This negative economic impact will flow through to affect all aspects of the private and government sector.

4.3 Discussion

There is currently limited data to enable Vanuatu to plan responses to climate change impacts. Vulnerability can only be identified in a general sense. At this stage it is not possible to quantify and prioritise vulnerability at a local or island level. For Vanuatu to be better able to identify vulnerability to climate change impacts there is a need for:

- Better understanding of local effects of tectonic processes and how these correlate with possible sea level change scenarios on individual islands.
- Better understanding of the link between climate, agricultural productivity of different crops and crop varieties, incidence of disease vectors and water supply.
- Better understanding of the ENSO and modeling of its effects on weather patterns throughout the archipelago.
- More detailed climate change and sea level models that allow the vulnerability of individual islands, or groups of islands, to be quantified and prioritised.
- More regular updating of geographic information systems to allow comparisons of land use over time.
- Additional data in the national GIS to allow low-lying coastal areas to be mapped and storm surge zones modeled for planning purposes.
- Assessment of the vulnerability of social communities, that take into consideration the diversity of social development pressures and needs, so as to enable climate change impacts to be evaluated in the broader context of social development priorities, and to enable appropriate coping mechanisms (traditional

and modern) to be identified.

5 ADAPTATION

Adaptation refers to changes in technologies, practices and policies that can prepare a country for the impacts of climate change resulting from GHG emissions. Adaptation opportunities for each of Vanuatu's key vulnerabilities as identified in chapter 4 are presented below.

5.1 Sectoral adaptation opportunities

5.1.1 Agriculture

- a. Subsistence and commercial agriculture are based on a small number of commodities. Diversification of crops will help increase the resilience of agricultural systems to climatic extremes.
- b. In general commercial horticultural and livestock species are relatively well understood, whereas the productivity, growth requirements and pathogens of the varieties of different subsistence food crops are poorly understood. Better understanding of the horticulture of subsistence food crops will provide a foundation for adaptation by enabling the selection and promotion of crop varieties suited to changed climatic conditions or resistant to particular pathogens. Crops of particular interest include yam, taro, manioc, kumara, banana and island cabbage. Such work would have the added benefit of increasing food security and identifying new market opportunities.
- c. Rural families rarely purchase seed or propagation material. Rather they select good seed or propagation material from one year's plantings to store and plant the next growing season. This ongoing process of crop selection strengthens the capacity of ni-Vanuatu agriculture to adapt to gradual changes in climate such as may be expected under GHG scenarios. It can also help to foster the development of new more productive crop varieties.

5.1.2 Human health

- a. Considerable progress has been made over the last decade to reduce the incidence of malaria and other vector born diseases and promote awareness of environment management strategies that aid vector control. Furthering this work will help minimise the impacts of climate change on the incidence of malaria, dengue and filiarisis.

Replication on other small islands of work on Tongoa that has drastically cut the incidence of malaria would be particularly beneficial. Care will be needed to minimise opportunities for re-infestation of parasites or vectors in areas where control has been established. However, in most areas a malaria eradication programme is not a practical option and may have high environmental and public health costs.

- b. Promotion of hygienic waste disposal methods will help to prevent contamination with disease pathogens in the event of cyclones and floods. Such adaptation strategies will provide health benefits regardless of cyclone frequency and intensity and whichever rainfall scenarios are manifest in the future.
- c. Management of surface water catchments will help to maintain quality of domestic water and continuity of water supply.

5.1.3 Water resources

Water resources are already stressed in many islands of Vanuatu and are vulnerable to negative impacts under GHG scenarios.

- a. Management of water catchments so as to maintain water quality and maximize groundwater recharge will minimise climate change impacts on water resources while providing immediate human benefits in areas that already suffer seasonal shortages and helping to maintain environmental quality. This could be achieved through integrated planning efforts involving rural landholders, provincial authorities, and departments of lands, agriculture, forestry, mines, water supply and environment or by legal or administrative restrictions on activities impacting on water catchments. Catchment management initiatives would have wider environmental benefits, including reduced erosion and soil loss, maintenance of biodiversity and land productivity.
- b. Improved management and maintenance of water supply networks to reduce wastage will also reduce vulnerability in both urban and rural areas. This will require training in maintenance of taps, tanks and pipes and access to appropriate hand tools.
- c. Extension initiatives that promote water conservation and moderate usage, while raising awareness of the importance of water resource management, will also help to maintain long-term water supplies.
- d. Introduction of policies to extract freshwater from coastal aquifers only where there are no feasible alternatives would reduce the vulnerability of coastal communities and reduce the need to replace infrastructure should salt water intrusion occur .
- e. Expansion of rainwater storage capacity, frequently through the installation of water tanks will reduce the vulnerability of communities in times of water shortage.

5.1.4 Coastal developments

Land use and physical planning mechanisms provide a means for municipal and provincial governments to minimise the impacts of climate change and sea level rise on infrastructure, human settlements and agriculture.

- a. Modeling of the storm surge zone, taking into consideration possible sea level rises, provides a powerful tool for reducing vulnerability. Planning mechanisms can be used to direct all new investments in infrastructure, housing construction and agriculture outside this zone to minimise vulnerability, reduce repair costs and decrease disruption to economic activities.
- b. Planning initiatives could require that infrastructure, including bridges, roads, wharves, communication services etc., be engineered so as to withstand cyclone, high floodwater flows and high intensity rainfall.
- c. Exclusion of extractive activities from the coastal zone, including sand extraction and mangrove enables these areas to provide a protective buffer from impacts of coastal erosion. Replanting littoral vegetation in cleared or degraded areas would restore their coastal protection benefits.
- d. Disaster planners can help communities prepare for worst case impacts by

identifying coping strategies. This will require identification of locations of high vulnerability, awareness raising initiatives to help local communities make appropriate decisions about their own futures and technical planning for relocation should this be required.

5.1.5 Coastal marine environments

Impacts on the vitality and productivity of coastal marine environments will follow from increased sea level temperatures and elevated CO₂ concentrations in seawater as well as increased intensity and frequency of storm events. Such impacts are global and cannot be easily prevented or accommodated at a local or national level.

Adaptation strategies to any reduction in harvests of marine resources will need to focus on replacement of fishing with alternate sources of protein and alternate economic opportunities for rural villagers. This could include marine or freshwater aquaculture or shifting emphasis to land based economic and food production activities. Either adaptation will require considerable initiative given the limited economic opportunities presently available in some islands.

5.1.6 Social and cultural concerns

Ni-Vanuatu society and culture is, currently, stressed by complex socioeconomic changes and changing community values. The additional impacts of climate change on food security, land resources and water availability, could lead to further deterioration of social systems and law and order. Identification of coping strategies requires on-going involvement of key social institutions including chiefs, women's organisations and churches. These organisations have not to date contributed to PICCAP discussions. There is opportunity to foster collaboration between social institutions to identify and prioritise social vulnerabilities and identify culturally appropriate adaptation strategies. Such work cannot be specific to climate change scenarios and so is likely to have broad reaching benefits as Vanuatu goes through ongoing social pressures and changes.

5.1.7 Broad economic impacts

Strategies to minimise the broad economic impacts of climate change have been mentioned in the context of specific sectoral adaptation strategies. They include expanding the range of agricultural products; selection of plant varieties better suited to predicted future climates; identifying opportunities to reduce reliance on coastal marine resources; and relocating infrastructure to areas of low vulnerability.

5.2 Adaptation response strategies

Vanuatu's vulnerability to climate and sea-level change will be determined by the decisions that are made today with respect to the management of resources and the nature of social and economic development, as much as the magnitude of effects and the effectiveness of specific adaptation measures.

Vanuatu is in a position to adopt pro-active adaptation strategies that can be implemented immediately and sustained over coming years to effectively reduce vulnerability to the future impacts of climate change. However, there are three obstacles to be negotiated:

1. in the present socio-economic climate it is difficult to identify national resources

that could be redirected to climate change adaptation activities from immediately pressing social development needs.

2. climate change issues are, in general, poorly understood and
3. despite efforts to make climate change planning multi-sectoral it has not been incorporated into the mainstream planning activities of governments and sectoral organisations.

6 MITIGATION

Mitigation refers to measures that will reduce the national release of GHGs. Most commonly mitigation measures can either reduce people's demand for GHG emitting products or else control their supply. They can incorporate education and awareness raising initiatives, fiscal measures such as financial incentives, taxes and charges, legislation to prohibit certain activities and policy measures.

PICCAP has addressed mitigation measures at a regional level and this section of the national statement considers relevant measures for Vanuatu. It is noted, however that limitations in the base GHG inventory (chapter 2) constrains the selection of appropriate mitigation measures. However, to have significant reductions in the national emissions of GHG gases any mitigation measures will need to target the release of carbon dioxide transport and electricity generation sectors.

6.1 Mitigation options in the energy sector

Opportunities for immediate mitigation are small given the imbalance in energy use (electricity and fossil fuels) between urban and rural ni-Vanuatu; the extremely low use of energy appliances at a national level; and the importance of access to energy for social development .

6.1.1 Encourage public energy awareness to reduce use of high power consuming appliances.

All appliances are imported. Many are already free of GHG and labeled for energy efficiency. However few ni-Vanuatu understand the labeling used or realise its purpose. Greater awareness of energy labeling, appliance efficiency and operating costs is necessary to influence consumer behavior.

6.1.2 Ban low efficiency appliances

There is considerable variation in the efficiency of appliances imported into Vanuatu. GHG mitigation and energy and economic benefits can be achieved by prohibiting import of low efficiency appliances.

6.1.3 Improve operating efficiency of vehicles and appliances

Many appliances and vehicles operate at less than optimal conditions due to poor maintenance and repair. Improvements in operating efficiency will require greater awareness of the costs savings that result to the user and training of technical personnel in the maintenance and repair of appliances.

6.1.4 Decrease dependency on fossil fuels / increase use of renewable energy alternatives

Diesel generators provide the majority of electricity in Vanuatu, particularly in the two main urban centers. Vanuatu has significant potential to use a range of alternatives for generation of electricity: geothermal, hydro, solar and wind in particular.

Construction of the Sarakata 600kW- hydro power plant has been a major initiative to reduce dependency on fossil fuels in Luganville. It is planned to double this plants generating capacity as demand increases. There is considerable opportunity to increase the use of hydropower on islands with good surface water supplies. In

areas without suitable water resources solar power is being promoted to provide light in homes, health centers, schools, churches. However both hydro and solar systems require substantial initial investment and this is not a priority to the majority Ni-Vanuatu. They are also complex technologies requiring skilled operation and maintenance if to operate optimally. Training of local personnel to repair and maintain these systems is crucial.

Wind speeds throughout the Vanuatu islands are modest and variable, while cyclonic storms are a threat to wind generators. Consequently there has been very little work on wind power generation.

6.1.5 Impose strict operating conditions on public electricity utilities

Strict conditions on the efficiency and emissions from generation facilities and the efficiency of electricity supply networks can minimise wastage of fossil fuels and reduce GHG releases. Given that only 2 urban centres have substantial networks and both have established generating facilities phasing in of restrictions may be most appropriate. Small diesel supply networks in rural areas or at Provincial administration centres may prove difficult to control initially because of limited technical capacity to maintain systems. Training of technical staff would complement improved operation of public facilities.

6.1.6 Further documentation of GHG emissions to enable better projection and mitigation analysis.

Improved statistical data on import vehicles, small motors, engines, household generators, industrial equipment, electrical appliances etc. is fundamental to identification of improved mitigation strategies. Such strategies will be dependent on securing appropriate funding and technical expertise.

6.1.7 Promote use of fuel wood

Fuel wood is the most widely used energy source in Vanuatu, primarily for cooking, boiling water and drying agricultural produce, but it has also been used for gassification. Fuel wood is renewable and as such an important alternative to use of fossil fuels. GHG mitigation would benefit from promotion of fuel wood and disincentives for cooking on gas, especially in rural areas where fuel wood is readily available. Promotion of timber lots to produce fuel wood for local use and national markets could be considered.

6.2 Mitigation for land, sea and air transport sectors

Gains made by improving the efficiency of transport operations can be important mitigation measures. However demand for transport of all kinds has increased over the past decade and is likely to continue to increase in the foreseeable future.

6.2.1 Improve efficiency of vehicles, ships and planes

Gains in air transport emissions are not considered realistic at this stage given the dependence on international markets for planes, engines etc.

The domestic shipping fleet is aging and generally in poor repair. Legislation requiring ships to improve standards comes into force in year 2000. This will force improvements in the efficiency and operating standards of vessels and indirectly

mitigate releases from this sector.

All motor vehicles are imported and so engine capacity and efficiency reflect standards in neighboring countries with larger markets. With such a small internal market Vanuatu has limited opportunity to request modifications to meet national standards. Even so regulatory and fiscal controls may be most effective. These include:

- ◆ Increased road taxes and import duties on large engine /low efficiency vehicles.
- ◆ Enforcement of the Vehicle Efficiencies Act
- ◆ Efficiency labeling accompanied by awareness raising as to the meaning and purpose of the labels.
- ◆ Upgrading of roads in Port Vila and Luganville, as well as in the outer Islands.

Traffic congestion in Port Vila forces vehicles to operate at less than optimal conditions. Measures to improve traffic flow, re-route through traffic and reduce stop-start operation conditions would reduce urban emissions of GHGs.

6.2.2 Reduce demand for transport

Vehicle users are highly resistant to attempts to reduce their use of vehicles and Ni-Vanuatu place a high value on mobility, regarding this as much more important than environmental benefits or even appreciable financial benefits to themselves. Transport is also integral to socioeconomic development being a key consideration in produce marketing, and access to health, education and other social services.

Increased decentralisation of services and economic activities coupled with greater development of local markets would do much to reduce the current dependence on inter island transport with Port Vila and Luganville as the hubs. Such a change would be facilitated by economic incentives for skilled workers and entrepreneurs to establish themselves locally rather than being based in one of the two urban areas. Gains from reduced emissions from inter-island transport are, however, likely to be offset by increased local vehicle use as local cash economies become better established.

6.2.3 Land transport

Liquid fossil fuels are easily distributed and used throughout the country and in the transport sector have low potential for non-fossil substitutes.

6.2.4 Promote use of public transport

Due to costs walking remains the most common form of transport. Ni-Vanuatu who can afford utilise public transport services, and there is only a low level of private vehicle ownership. There is, however, a trend toward increased private vehicle ownership in urban and rural areas. A reduction in this trend could be affected by increased taxes on private vehicle ownership or fuels, restrictions on access of private vehicles to urban centres or reducing costs for use of public transport.

6.2.5 Promote bicycle use and walking

Bicycle use has increased in urban and rural areas over the past decade, yet remains small. Wet season rains, traffic congestion, poor road conditions, safety

concerns and steep hills discourage bicycle use in Port Vila. Initiatives to increase bicycle use would include awareness raising among other road users, marking of bicycle only lanes on main roads in Port Vila, removal of import duties, provision of bike racks etc.

Similarly improvements in footpaths, street scaping to provide shelter for pedestrians and similar urban planning initiatives could be used to encourage walking for short journeys.

6.3 Forest conversion

Forests can be considered sinks for GHG. Mature forests exist in a state of equilibrium and net changes in GHG emissions are only recorded where the standing biomass is increasing (planting of new forests) or decreasing (clearing of forests through burning etc.). Vanuatu remains almost 70% forested, with non-forested lands primarily used for agriculture, gardening and settlements. In recent years clearing and conversion of forests to agriculture land has been encouraged though government policies and changing economic needs.

Preventing further conversion would reduce GHG emissions, but would not be economically or politically possible. Rather promotion of agro-forestry regimes that enable maintenance of standing biomass may be a more appropriate option.

6.4 Discussion

Vanuatu is a very minor producer of GHG emissions both in terms of total emissions and emissions per head. Mitigation measures will enable Vanuatu to minimise any increase in its GHG emissions, but due to existing needs for social and economic development, a reduction in releases is not an immediate goal.

7 CAPACITY TO RESPOND TO CLIMATE CHANGE

7.1 Background

While Vanuatu, through its representative at the UN was active at all stages in development of the UNFCCC, this level of awareness and commitment is not shared by many in-country organisations and individuals. The majority of the population including many policy and decision makers within government and non-government organisations in Vanuatu have minimal understanding of the various aspects of global climate change, its implications and ramifications at a local and national level.

On the other hand ni-Vanuatu have in depth knowledge of their local environments and are familiar with subtle changes in climate, resource stocks and coastal conditions. Adaptation to these changes and management of their impacts is inherent to their success in subsistence farming and fishing, and modern agriculture. This capacity is the nation's greatest asset in responding to climate change as long as the scale of any climate changes is not beyond current expectations.

7.2 National Capacity

As a developing country, most organisations in Vanuatu have limited capacities: in terms of staff numbers, numbers of technical staff, access to technical equipment and financial resources. Government agencies focus on immediate and practical priority issues and have difficulty maintaining the current level of services in key sectors such as health and education. While recognising the long term importance of reducing GHG emissions and preparing for climate change it is difficult for the government to take the longer term economic decisions necessary. This situation is unlikely to change in the medium term. Consequently there is a high dependence on support and leadership from more affluent countries if Vanuatu is to meet its obligations under the UNFCCC.

Vanuatu has benefited from initial participation in the regional PICCAP project. This includes training of a small number of staff in GHG inventory and vulnerability assessment. However this will have limited long-term impact if there are not the funds to maintain staff positions and expand upon initial awareness raising at a government level.

Discussions leading to the development of this national communication to the conference of parties gave high priority to low cost initiatives to institutionalise and mainstream climate change and increase national capacity to prepare for and adapt to climate change. These have become high priorities in the national action plan for climate change. High priority has also been allocated to training and information gathering that will assist national organisations in the longer term to prepare for climate change.

To enable this mainstreaming activities must be complemented by improved documentation of GHG emissions and climate change vulnerability. At present there is insufficient information available to describe climate change scenarios within Vanuatu in anything other than a very general hypothetical sense. Improving the national knowledge base is a necessary first step to raising commitment among skilled public servants and decision makers. This requires immediate commitment to data gathering, supplementary research, technical and scientific training and strengthening of the networks established by the PICCAP project for information sharing and multi sectoral planning.

Sufficient knowledge to provide specific locally relevant advice is also a necessary first step to raising awareness at a provincial and community level. Messages based on generalities but without a tangible foundation are likely to cause confusion, possibly raise unnecessary fears and reduce long-term commitment as people are not able to focus on practical responses in their locality.

7.3 Provincial Capacity

While the national government lacks capacity to respond to climate change, capacity at the Provincial level is even more limited. The Provincial administrations have few trained technical staff, none have dedicated environmental officers or planners, and all have extremely limited resources. However their participation in development of this national communication is indicative of their desire to be better informed and better equipped to deal with the situations that may arise and help people at a local level understand and prepare for climate change.

As more information becomes available it will be important to develop skills and support for the preparation of climate change action plans for Vanuatu on both a provincial and an island by island level.

7.4 Community capacity

At a community level there is very limited understanding of the concepts of greenhouse gas induced climate change. Public Awareness activities commenced by the Environment Unit during rural workshops and radio broadcasts have been expanded under the PICCAP project but remain limited and unfocussed. The most significant initiative to date has been involvement of Provincial level planners in activities to explore impacts of climate and sea level change and to identify response initiatives and responsible institutions.

Community awareness raising under the PICCAP project has drawn heavily on radio. However radio, being unable to provide visual and physical cues and having language barriers, is a difficult medium in which to promote initial appreciation of the highly complex climate change issues. Better results would come from alternative approaches that enable visual cues to illustrate complex terms, questioning and discussion.

As a long-term strategy to raise community capacity there is opportunity to incorporate topics related to global climate change in the curricula of primary and secondary schools. This will provide future generations with scientific understanding of global climate change and to take into the future the interest in the decision making of climate change policies within the nation. The first step towards this is development of educational aids suitable for classroom use. As few teachers, especially at a primary level, have capacity to teach such subjects, there is also the need to introduce environmental issues such as climate change to the curriculum of trainee teachers and in-service training courses provided for existing teachers.

Even with changes mooted under the National Education Master Plan, it is unlikely that the general population will have the scientific literacy to fully understand concepts underpinning the climate change and sea level rise issues. Applied focuses at a community level, that transfer skills in disaster preparedness, community planning and adaptation to change will in many cases be more productive than

attempts to raise understanding. There is a wealth of participatory skills on which such work could be founded, and conducted through existing ngo networks.

Both government and non-government institutions in Vanuatu have effectively stimulated interest and understanding of environmental issues through workshops, role-plays, theatre, radio, TV and Video shows. Climate change is a multi-sectoral issue well suited to incorporation into existing awareness programs that already focus on related themes.

8 A NATIONAL RESPONSE TO CLIMATE CHANGE – STRATEGIES FOR ACTION

8.1 Mission statement

Climate change is recognised as a national issue that requires timely and committed initiatives by government to develop capacity to address existing and potential impacts on the livelihood of the people of Vanuatu.

8.2 Objectives

- 1. Institutionalise and mainstream climate change preparations**
- 2. Increase national capacity to prepare for and adapt to climate change**
- 3. Minimise increases in national GHG emissions in the medium term**
- 4. Increase community understanding of climate change and their preparedness.**

8.3 Preamble

Climate change is a new science in Vanuatu.

Vanuatu will be best able to adapt to climate change and reduce national vulnerability by setting in place immediately national policies and operational procedures and guidelines for appropriate management of natural resources, investments in infrastructure and the nature of social and economic development of Vanuatu.

The role and position of the NACCC and the PICCAP project should be considered in light of the need to institutionalise capacity for climate change adaptation. The NACCC should be strengthened as a national advisory committee with capacity to review and comment on national development plans and projects. The PICCAP funded position should provide secretarial and administrative support to NACCC. In this capacity the PICCAP coordinator will need to work closely with national, sectoral planners and legal institutions to affect changes in the national policy and planning framework. Responsibility for work and implementation of action strategies should be contracted through relevant government departments and in-country NGOs wherever possible (Fig 8.1).

Priorities identified in this action plan recognise that adaptation to changing climate is an on-going process over the next half century and beyond. This plan is only the first step, and the foundation for work to come. It consequently provides an emphasis on developing national and provincial level capacity: through research, improved documentation, training and mainstreaming initiatives. With this in place Vanuatu will be in a much stronger position to put in place measures to reduce vulnerability and foster adaptation.

8.4 Implementation Strategies

8.4.1 Institutionalise and mainstream climate change preparations

Discussions leading to the development of this national communication to the conference of parties gave high priority to low cost initiatives to institutionalise and mainstream climate change and increase national capacity to prepare for and adapt to climate change. These have become high priorities in the national action plan for climate change. High priority has also been allocated to training and information gathering that will assist national organisations in the longer term to prepare for climate change.

As more information becomes available it will be important to develop skills and support for the preparation of climate change action plans for Vanuatu on both a provincial and an island by island level.

	Lead or executing agency	Components	Resources needed	Time frame
Require GHG potential and climate change vulnerability to be considered in all government project plans and programming.	DESD	<ul style="list-style-type: none"> Consider vulnerability to climate change and sea level rise on all government planning documents. Consider vulnerability to climate change and sea level rise in all new works programmes. Consider vulnerability to climate change in all project proposed for external funding. 	None	immediate
Modify existing legislation to prevent new developments in vulnerable areas (Physical Planning Act; Foreshore Development Act & Urban Water Protection legislation).	NACCC in consultation with the State Law Office	<ul style="list-style-type: none"> Paper to COM identifying issues to address. Request to State Law Office to draft necessary amendments 	None	immediate

8.4.2 Building national level and understanding

The majority of the population including policy and decision-makers within the organisations in Vanuatu has very little knowledge of various aspects of global climate change, and it's ramifications in their daily activities. Without adequate understanding of issues and the country it is difficult to target responses.

The NACCC Workshop to set priorities and action plans for climate change in Vanuatu, identified food resource and water supply, lowland areas receive high priority to be vulnerable to climate change and sea level rise. However, there are gaps in the information gathered to quantify vulnerability of food and water resources and the lowland areas. There is a need to set researches and monitoring of food and water resources in relation to subtle changes in climate. Large developments throughout the islands of Vanuatu and inshore fisheries that are important for the livelihood of the majority Ni-Vanuatu are within the lowland areas and are vulnerable to sea level rise. Lowland areas <5m, not represented in existing maps are particularly important for the monitoring of vulnerability of lowland areas to sea level rise.

	Lead or executing agency	Components	Resources needed	Time frame
Documentation of variation of common food crops, their horticulture and capacity to grow well under different conditions.	Agriculture Department	Variety studies of crops such as yam, taro, banana, island cabbage etc. Studies of pests and diseases affecting these crops. Selection of varieties best suited to different climatic conditions	Finance for research (travel, collections, documentation, staff) and trials.	Immediate start
Mapping of the areas <5m asl and storm surge zones, and inclusion of this data in tools such as VANRIS.	Survey department and Land Use Planning Office.	Interpretation of existing maps and aerial photos, and digitisation to include in VANRIS.	Finance for staff time.	Immediate start

	Lead or executing agency	Components	Resources needed	Time frame
Documentation on the status of water sources.	Geology And Hydrology Department	<ul style="list-style-type: none"> • Conduct a rapid assessment of ground and surface water resources. • Monitoring changes in water quality and volume, usage and recharge or flows. 	Finance for research and monitoring	Immediate start
<p>Improved management of water catchments in rural and urban areas...</p> <ul style="list-style-type: none"> • Extension and training to improve awareness and local capacity • Legislative controls 	Geology And Mines, Environment Unit And Provinces.	<ul style="list-style-type: none"> • Preparation of extension resources • Establish demonstration sites • Consult with State Law Office over legal drafting. 	Finance for development of information materials and establishment of demonstration sites.	Immediate start

8.4.3 Improving networks for information transfer and coordinated adaptation and mitigation measures.

As more information becomes available it will be necessary to translate this from scientific formats to messages appropriate for government agencies and planners and to inform public. The network established by PICCAP project provide an initial core that needs to be strengthened and expanded. Initial emphasis should be on information sharing and creating linkages for data transfer between departments and provinces.

	Lead or executing agency	Components	Resources needed	Time frame
<p>Include climate change data in existing databases</p> <ul style="list-style-type: none"> • State of Environment Management database (Statistics Office) (new fields for GHG emissions & climate) • VANRIS Database (LUPO) (digitising areas of high vulnerability, storm surge zones, water catchments). • Foster links between databases so data on GHG emissions and vulnerability is widely accessible. • Review fields in Government databases to ensure data is in a form that assists with GHG inventory and vulnerability assessment. 	<p>Statistics Department LUPO</p> <p>With guidance from NACCC and assistance from PICCAP Coordinator</p>	<ul style="list-style-type: none"> • Reviewing fields in existing databases. • Identifying gaps and either sources for this information or establish new data gathering processes. • Digitising data for entry to VANRIS. • Periodic review and data gathering. 	<p>Finance for additional programming, data collection and data entry.</p> <p>(Draw upon information in existing databases where possible, encourage modifying data formats to provide information required for vulnerability assessment etc.)</p>	<p>Immediate start</p>

	Lead or executing agency	Components	Resources needed	Time frame
<p>Establish and institutionalise on-going data collection mechanisms...</p> <ul style="list-style-type: none"> • GHG emissions • GHG sinks • Tree felling • Replanting • Livestock • Clearing for agriculture • Use of fuel wood • Coral reef health 	NACCC in consultation with Statistics Office and relevant Departments	<ul style="list-style-type: none"> • Identify data already held in various departments and the format in which it is held • Identify gaps and needs for GHG inventory and vulnerability assessment. • Identify appropriate opportunities to gather this data. • Seek funding to enable appropriate agencies to expand current activities if necessary. 	Budget for data collection and analysis	Immediate start
Establish networks for dissemination of technical information to Departments and Provinces	NACCC		Assign initially to PICCAP coordinator and identify long term strategy to institutionalise information dissemination.	Immediate start

8.4.4 Increase national capacity to prepare for and adapt to climate change

With a low level of understanding of climate change issues, limited information describing Vanuatu's vulnerability to climate change and limited technical and financial capacities, Vanuatu lacks capacity to respond to climate change. It is necessary to develop skills and financial and human resource support to prepare for climate change.

	Lead or executing agency	Components	Resources needed	Time frame
Specialist training of staff in all sectors, provinces and ngos i) understanding of vulnerability ii) understanding of how to adapt	NACCC to coordinate. Agriculture, hydrology, fisheries, meteorology and environment unit to develop training content.	<ul style="list-style-type: none"> • Training needs assessment • Identify training opportunities in the region. • Identify appropriate individuals for training • Seek funding 	Finance for staff, workshop and travel costs.	Short term
Environment Unit strengthening	Ministry Of Lands, Natural Resources And Rural Water Supply	<ul style="list-style-type: none"> • Political commitment and support 	Budget to enable transition to Department level, fill positions in the approved organisational structure and conduct work.	Short term
Increase technical staffing at Provincial level	Department Of Provincial Affairs In Association With Provincial Governments and Scholarships Office.	<ul style="list-style-type: none"> • Training Needs Assessment • Identify training opportunities in the region. • Identify appropriate individuals for training • Seek funding 	Funds & training & scholarships	Short term

8.4.5 Minimise increases in national GHG emissions in the medium term

While Vanuatu does not aim to decrease GHG emissions or emissions per head during the life of this plan, it recognises its responsibility to minimise increases where possible. Information available from the baseline GHG inventory suggests mitigation measures must firstly focus on releases from the transport and electricity sectors. These are targeted in the following implementation activities.

	Lead or executing agency	Components	Resources needed	Time frame
Require annual mechanical inspections of all land and sea vehicles as a condition of paying annual road tax.	Customs and Police	<ul style="list-style-type: none"> • Develop inspection criteria. • Train private mechanics in inspection requirements. • Prepare legislation and enforce it. 	Funds for papers and training activities.	Short term
Investigate prices of vehicle spare parts and the contribution of tax to their price. If taxes are excessive consider reducing them to encourage better maintenance.	NACCC with Customs Department	<ul style="list-style-type: none"> • Investigate tax regimes • Report to COM 	None.	Short term
Ban import of fuel inefficient vehicles, engines and appliances.	NACCC with Customs Department and Attorney Generals	<ul style="list-style-type: none"> • Develop criteria for gauging efficiency. • Prepare necessary legislation and enforce it 	Funds for research component	Medium term
Awareness to improve understanding on appliances' efficiency and labeling.	Energy Unit	<ul style="list-style-type: none"> • Development of appropriate awareness materials 	Funding to develop information kits	Short term

	Lead or executing agency	Components	Resources needed	Time frame
Encourage non timber forest products	Agriculture and Forestry Department	<ul style="list-style-type: none"> • Ongoing trials of different systems • Extension and demonstration work. 	Use of existing extension services	short term
Encourage sustainable agriculture systems.	Agriculture and Forestry Department	<ul style="list-style-type: none"> • Ongoing trials of different systems • Extension and demonstration work. 	Use of existing extension services	Short term
Conduct a feasibility study of opportunities to make greater use of renewable resource and reduce dependency on fossil fuels.	Energy Unit	<ul style="list-style-type: none"> • Conduct feasibility study • Draw recommendations and act upon them 	One technical staff person for 12 months to conduct feasibility study.	Medium term

8.4.6 Increase community understanding of climate change and their preparedness.

Planning and preparedness are not unique to climate change. The same participatory planning skills will be of general benefit as local communities resume control for local development and ensure local disaster preparedness.

There is a need to establish a network of skilled trainers within government and non-government organisations that will be able to conduct preparedness and planning training at the local level. Existing government networks (National disaster office, cultural centre rural field workers, Forestry, Fisheries and Agriculture extensions, schools) should be used in preference to establishing new training networks.

	Lead or executing agency	Components	Resources needed	Time frame
Train trainers in community planning and vulnerability assessment from among the natural disaster network, ngo staff and provincial area secretaries	NACCC to coordinate. Agriculture, hydrology, fisheries, meteorology and environment unit to develop training content.	<ul style="list-style-type: none"> • Preparation of training materials • Conduct of training of trainers workshops 	Finance for staff, development of materials, workshop and travel costs.	Short term
Community training for preparedness.	Natural disaster network, NGO and Provinces	<ul style="list-style-type: none"> • Preparation of training materials • Conduct of training workshops 	Finance for travel, training materials and workshop costs.	Short term
Encourage traditional and modern food preservation techniques	Culture Centre, Disaster Office.		Use established culture centre and disaster networks.	Medium term
Incorporate climate change into the formal education curriculum including: <ul style="list-style-type: none"> • Teacher training • Classroom materials 	NACCC AND CDC		Fund local consultant to work with CDC to develop curriculum and classroom materials.	Medium term

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