National Summit to Improve Understanding on Climate, Climate Change and its Impacts on Agriculture and Land-based Sectors

12-16 March 2012

Vanuatu Agriculture College (VAC)
Luganville, Santo Island

VAC

ACKNOWLEDGEMENTS

This report is a collaborative effort from the VMGD, SPC-GIZ, NDMO and DARD. The following persons are acknowledged for contributing to compiling the report

From VMGD: Salesa Kaniaha, Philip Malsale, Silas Tigona, Mike Waiwai, Melinda Natapei, Kathriana Kanas, Kylie Lowson

From SPC-GIZ: Dr. Christopher Bartlett, Thomas Putunleta, Isso Nihmei, Rebecca Bill

From NDMO: Pete Turnbull, Alice Iarem

From DARD: Peter Iesul

All presenters, contributors and participants in the summit are acknowledged (Appendix). Special acknowledgment is given to Director Jotham Napat (VMGD), Director Benuel Tarilongi (VQL), Acting Director Tate Hannington (DoF), Acting Director James Wasi (DARD) and CEO Peter Napwatt (VAC) for their guidance, contribution and participation throughout the workshop.

The PI-CPP provided a substantial financial support to this workshop and the contribution is acknowledged. SPC/GIZ also contributed financial support to the workshop

Contents

1.0 Background

Climate is always changing, and on a variety of time scales. Rarely uniform, climate is inherently variable and often punctuated by extreme events. Being prepared for the consequences of climate change, variability and extremes is a strategic policy option, once chosen by the Republic of Vanuatu. Adaptation to climate change, variability and extremes represents an important challenge for the sustainable development of society. As understanding of the climate system continues to deepen and society becomes more aware of climate-related benefits and negative impacts, public demand for robust climate information services is expected to grow. Communities will increasingly expect that climate information services are: *accessible*, *dependable*, *usable*, *credible*, *authoritative*, *responsive*, *flexible*, and *sustainable*. In many cases it is perhaps necessary to provide mechanisms that will trigger and encourage the interface between climate knowledge providers and users.

The World Climate Conference-3 (WCC-3) with the establishment of a **Global Framework for Climate Services (GFCS)** has brought a new momentum to integrate climate information and products into decision-making in all socio-economic sectors, through an effective two-way dialogue between providers and users. This national summit, as its overall objective, sought to refine the interface among climate knowledge providers and users, to enable more regular and profound *use* of climate knowledge services available in Vanuatu. Specifically focusing on land based sectors (Agriculture, Forestry, Livestock and Environment), summit organizers sought to target those most directly affected by climate change, variability and extremes, and who could most benefit from the use of targeted climate information services for specific contexts. Of primary interest in this summit was the consideration and refinement of seasonal forecasting, a tool used to forecast climate extremes in the short term (2-3 month outlooks).

The summit's theme, "thinking globally and acting locally" was chosen as our nation attempts to cope with a global phenomenon through local action and grass roots adaptation interventions. Priority areas for adaptation in Vanuatu's National Adaptation Plan of Action (NAPA) were identified through a national consultation exercise. Food Security (and the Agriculture Sector generally) was identified as the highest priority area for adaptation by the national government. This priority was reiterated during separate regional workshops attended by Vanuatu's Ministers for Health, Agriculture and Trade. As a result, Vanuatu held its Food Security Summit in 2009 led by the Ministry of Health.

The localized adaptation strategies being developed and promoted are intended to address those immediate and tangible impacts now being felt in ni-Vanuatu communities. While long-term change is being measured in Vanuatu through increasing temperature ad sea level rise, the most immediate adaptation requirements address climate variability (ENSO) and associated extreme events. Directly affecting our day-to-day lives, changes to the frequency and intensity of ENSO events is a direct manifestation of climate change.

While climate impacts on agriculture and food security are severe and currently experienced, other sectors are also face unprecedented impacts. Impacts on forestry and livestock are projected to be equally serious for ni-Vanuatu, particularly as nearly all farmers practice mixed production systems. Tree species such as the five priority species of the Department of Forests (Natapoa, Whitewood, Sandalwood, Nangai and Mahogany) each have specific and well-delineated climatic and environmental tolerances that can be used, alongside forecasting tools, for local-scale adaptation. Similarly livestock species in Vanuatu are extremely vulnerable to climatic fluctuations. The seasonal forecasts provided by the Vanuatu Metrological and Geohazards Department can influence the decisions farmers take to prepare for and recover from extreme events.

This summit was organized to provide an opportunity for representatives from the Department of Agriculture, the Department of Forestry, the Department of Quarantine and Livestock, government extension field officers, Academia such as the Vanuatu Agriculture College (VAC), established research institutions such as the VARTC, Scientific institutions such as the Australian Bureau of Meteorology, Vanuatu Meteorology and Geo-hazard Department, regional technical agencies such as SPC-GIZ and others to discuss a way forward.

The forum has enabled the discussion and identification of practical and easy-to-do adaptation solutions in response to climate change, variability and extremes. Achieved by aspiring to a holistic multi-sectoral, multi-agency approach and the pooling of resources, this summit served as a model for tackling climate change at the community level in Vanuatu. Furthermore, the workshop engendered a deeper appreciation for solid scientific agro-meteorological services that respond to local food security issues in an integrated way.

This report presents strategies to effectively integrate and adapt to climate change, variability and extremes; both those discussed during the summit and others included from around the region. It is hoped that this document will become a valuable resource from which many institutions, both government and non government, can utilize.

1.2 Summit Coordination and Participants

The summit was coordinated by the Vanuatu Meteorology and Geo-hazards Department, SPC-GIZ and the Department of Agriculture and Rural Development. The workshop targeted government and non-government extension officers of the land based sectors of Vanuatu and in particular, Agriculture, Forestry Livestock and Environment.

The workshop is organized through the financial support of:

- Australian Bureau of Meteorology (PI-CPP)
- SPC-GIZ Coping with Climate Change in the Pacific Islands Region Programme

And the in-kind support from

- Vanuatu Meteorology and Geo-hazards Department
- Vanuatu Agriculture College
- Vanuatu Agriculture and Rural Development

The workshop participants include;

- National Advisory Committee on Climate Change (NACCC):
- Vanuatu Meteorological and Geo-hazards Department (VMGD)
- Department of Agriculture and Rural Development (DARD)
- Department of Forestry
- Anglican Church of Melanesia
- Department of Livestock and Quarantine
- Department of Environment and Conservation
- SPC-GIZ:
- Vanuatu Agriculture Research and Technical Centre: (VARTC)
- Vanuatu Agriculture College: (VAC)
- Local NGOs: Farmers Support Association (FSA), Red Cross (RC), Care-International, Wan Smolbag(WSB), Nguna-Pele Marine and Land Protected Area Network (NPMLPAN).
- Regional Institutions
    - PI-CPP (Australia)
    - ClIMS Systems (New Zealand)

The detailed list of participants is attached in the Appendix

1.3 Overall Objective

The overall objectives of the workshop are as follows:

- **Train**: officers to better understand the concepts of climate, climate forecasting, climate change and its impacts
- **Identify:** opportunities and challenges faced by traditional crops, trees and animals related to climate and climate change and extreme events
- **Identify:** common crops, trees and animals that should be targeted for agro-meteorological information and possible project or activity opportunities (record traditional calendar and planting seasons)
- **Review:** mechanisms to effectively deliver practical agro-meteorological and climate change advisory products to all sections of society (commercial and traditional) and discuss ways to assist the users in various communities in their decision making
- **Explore:** opportunities to enhance the collaboration between Provider (VMGD) and Users (Agriculture officers, Farmers Associations, etc)
- **Explore:** discuss and agree on effective mechanisms for documenting and reporting impacts of climate extremes in each sector
- **Review:** Strategies for climate change adaptation options for different crops, trees and animals
- **Explore:** Training and capacity building needs and opportunities on climate and climate change (Curriculums to be developed for formal education, RTC's and VAC)
- **Identify:** priority areas for local crop research (VRTC) and mechanisms to deliver finished products to farmers prior to ensuing climate extremes
- **Strengthen:** the working relationship between Users and Providers of climate and climate change information (through MoA, attachment trainings, discussions, etc)

1.4 Outputs from the Workshop

The workshop was guided by outputs that were before or during the workshop. The outputs were developed to achievement part of the GFCS in ensuring effective dissemination to the last, bridge gap in the existing information and contribute to the development of services delivered to communities. Information from the workshop will also contribute to guide guidance climate change policy and must be reflected as achievements in a post WCC-3 period

Output 1: Set up ENSO Warning Procedures and a Directive

Output 2: Improve Communication and between VMGD and Agriculture and Farmers (MoU)

Output 3: Framework for collecting traditional knowledge

Output 4: Development of an ENSO Booklet (Forestry, Agriculture, Livestock)

Output 5: Revised Cropping Calendar

Output 6: Elements for a Proposal for Provincial Nurseries

Output 7: Validate SPC factsheets on livestock and climate change

Output 8: Best practice guideline for coastal rehabilitation through Forestry

Other outputs from the workshop are;

Output 9: Workshop Report

Output 10: Video Documentation of the Workshop

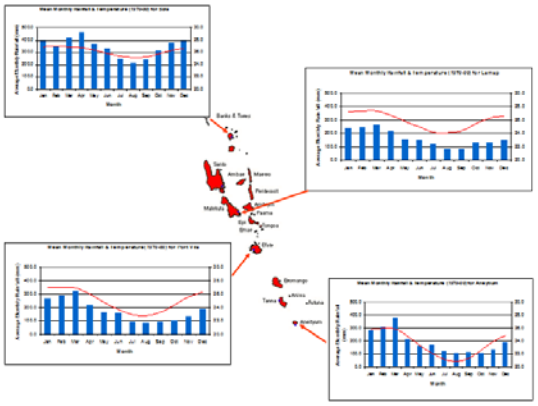
Output 11: ENSO Reporting Template

Output 12: GIS-base Database to Map ENSO Hot Spots

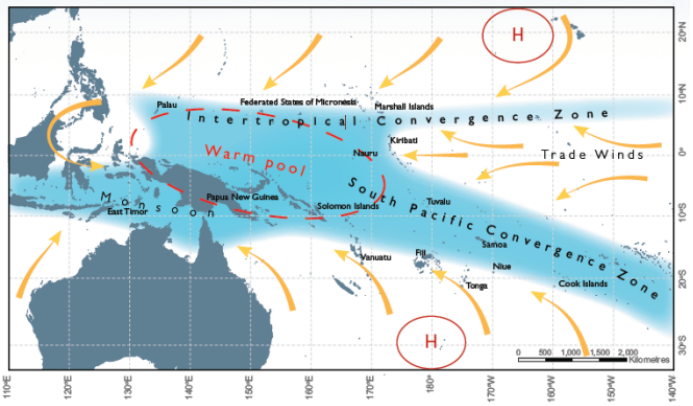
1.5 Format of the discussions and list of speakers/panelists

DARD, VAC, SPC-GIZ and VMGD invited representatives from land based sectors, and a number of speakers to make presentations followed by panel discussions and group activities targeted at achieving specific outputs. The workshop also included brainstorming discussions, hands on activities, and field trips.

2.0 Climate Change, Variability, and Extremes



Across Vanuatu the average temperatures ranges between 21°C from the South of Vanuatu during the dry season to about 27.5°C in the northern islands of Vanuatu during the wet season. Changes in the Temperature from season to season are strongly tied to changes in the surrounding ocean temperature. The country has two distinct seasons – a warm wet season from November to April and a cooler dry season from May to October. The figure above shows the average seasonal variation of temperature and rainfall from the meteorological stations in Vanuatu.



Rainfall in Vanuatu is affected by the South Pacific Convergence Zone. This band of heavy rainfall is caused by air rising over warm waters where winds converge, resulting in thunderstorm activity. It extends across the South Pacific Ocean from the Solomon Islands to east of the Cook Islands. During the wet season the South Pacific Convergence Zone intensifies and moves further south, bringing higher rainfall to Vanuatu. Low pressure systems embedded in this band of heavy rainfall often become tropical cyclones during the cyclone season (November-April).

Mountains also play a role in rainfall variation across some islands. During the wet season, rainfall is particularly high on the windward (south-east) side of the mountain ranges of the bigger islands, and scarce on the leeward (north-west) sides, especially during the dry season.

2.1 ENSO in Vanuatu

El Nino-Southern Oscillation (ENSO) is part of the global climate system consisting of El Niño and La Niña. ENSO typically causes significant impacts on the natural environment. In Vanuatu, El Niño normally coincides with below average rainfall that often leads to drought. For example, the remarkable 1982/83 and 1997/98 El Niño's had substantially negative impacts on Vanuatu's economy. La Niña on the other hand is usually associated with extreme rainfall events causing

flooding, erosion and outbreaks of water borne diseases. For example, the 1999/2000 La Niña caused the overflow and eventual disappearance of lake Siwi on Tanna island.

ENSO events (El Niño and La Niña) coincide with the shifting of the warm Pacific Ocean pool between the equatorial east and west Pacific respectively. During El Niño events, the warm pool shifts from the western equatorial to the eastern equatorial Pacific. This normally causes wetter climatic conditions in the eastern Pacific and drier conditions in the western Pacific, including Vanuatu. During La Niña, the warm Pacific pool intensifies and shifts to the western equatorial Pacific enhancing the normal climatic and oceanic conditions in the Pacific (e.g. wetter climate in Vanuatu) and drier conditions in the eastern Pacific. Apart from the Pacific basin, ENSO events also have significant effects on the natural environment in other parts of the globe. For instance, in parts of Africa, drought and floods mostly coincide with El Niño and La Niña respectively.

ENSO events usually occur every three to seven years; however it is expected that current global climate changes will increase the frequency of El Niño and La Niña phenomena, and thereby also increase the frequency of extreme weather events. These changes will have significant impacts on Vanuatu's food, water and socioeconomic development.

ENSO events have occurred over millennia, and are believed to have influenced the development of certain cultural and traditional practices in Vanuatu. For example, the invention of traditional food preservation in Vanuatu is mostly attributed to El Niño events. The ancient migration of the people in the Pacific is also credited to ENSO events. As ENSO events have occurred for thousands of years, there is well established local knowledge in place for predicting El Niño (drought) and La Niña (extreme rainfall) in Vanuatu. This local knowledge can be documented and used in tandem with modern science to enhance the reliability of seasonal forecasts and other climate services provided by the VMGD.

2.2 Vanuatu's Changing Climate

Temperatures have increased: Annual maximum and minimum temperatures have increased in Vanuatu since 1950. At Bauerfield Airport in Port Vila, maximum temperatures have increased at a rate of 0.17°C per decade and at Aneityum the rate of increase has been 0.18°C per decade. These temperature increases are consistent with the global pattern of warming.

	2030 (°C)	2055 (°C)	2090 (°C)
Low emissions scenario	0.2–1.0	0.5–1.5	0.7–2.1
Medium emissions scenario	0.3–1.1	0.8–2.0	1.3–3.1
I ligh emissions scenario	0.4–1.0	1.1–1.7	2.0–3.2

- Air temperature and sea surface temperature are projected to continue to increase over the course of the 21st century (*very high* confidence)
- By 2030, under a high emissions scenario, this increase in temperature is projected to be in the range of **0.4–1.0°C.**
- The intensity and frequency of days of extreme heat are projected to increase (*very high* confidence)
- Increase in the number of hot days and warm nights and a decline in cooler weather.

Port Vila's wet season rainfall has decreased: Data since 1950 for Port Vila show a decreasing trend in wet season rainfall (Figure 5). However, there are no clear trends in annual and dry season rainfall at Port Vila or annual and seasonal rainfall at Aneityum. Over this period, there has been substantial variation in rainfall from year to year at both sites.

- Wet season rainfall is projected to increase *(moderate confidence)*
- Dry season rainfall is projected to decrease *(moderate confidence)*
- Annual mean rainfall is projected to increase *(low confidence) Rainfall over Vanuatu is strongly influenced by ENSO*
- The intensity and frequency of days of extreme rainfall are projected to increase *(high confidence)*
- Little change is projected in the incidence of drought *(low confidence)*

2.3 Sea Level

Sea level has risen: As ocean water warms it expands causing the sea level to rise. The melting of glaciers and ice sheets also contributes to sea-level rise. The projections for the Pacific are expected to follow the global trend. Of course, sea levels are not static and naturally fluctuate over time, and in the Pacific there is considerable variability "associated with the El Niño-Southern Oscillation[1].

This is especially evident during abnormally high tides (such as king tides) that can be considerably higher than the average local sea level. Under increasing climate-induced sea level rise, the occurrence of extreme tide events is projected to increase.

[1] Church et al., 2006, p. 157

Sea level is controlled by many factors, some periodic (like the tides), some brief but violent (like cyclones), and some prolonged (like El Niño), In Vanuatu, tides are predominantly diurnal, or once daily, while elsewhere the tide tends to have two highs and two lows each day.

Instruments mounted on satellites and tide gauges are used to measure sea level. Tidal gauges are also used to do the same. A SEAFRAME gauge was installed in Port Vila, Vanuatu, in January 1993. It records sea level, air and water temperature, atmospheric pressure, wind speed and direction. When change in sea level is measured with a tide gauge over a number of years one cannot be sure whether the sea is rising or the land is sinking. To local people, the relative sea level change is of paramount importance.

Port Vila SEAFRAME Gauge installed in 1993

Vertical movement of the land can have a number of causes, e.g. island uplift, compaction of sediment or withdrawal of ground water. Continuous Geographical Positioning Systems (CGPS) are final link in establishing vertical datum control – that is, to determine whether the island or coastal region as a whole is moving vertically with respect to the International Terrestrial Reference Frame.

Atmospheric pressure is another parameter that can potentially influence relative sea level rise. Known as the inverted barometer effect, if a 1 hPa fall in barometric pressure is sustained over a day or more, a 1 cm rise is produced in the local sea level (within the area beneath the low pressure system).

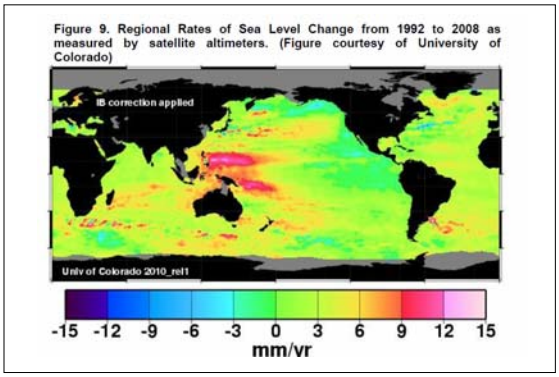


Figure 9. Regional Rates of Sea Level Change from 1992 to 2008 as measured by satellite altimeters. (Figure courtesy of University of Colorado)

Variations in monthly mean sea level include a moderate seasonal cycle and were affected by the 1997/1998 El Niño. The effects of the vertical movement of the tide gauge platform and the inverse barometer effect are removed from the observed rates of relative sea level change. The net sea level trends are positive at all sites, which indicates sea level in the region has risen over the duration of the project.

Satellite data indicate that sea level has risen near Vanuatu by about **6 mm per year since 1993**[2]. This is also confirmed by a separate report[3] that put sea level rise in Vanuatu at 5.6 mm per year

[2] PCCSP Vol 1 Country Reports, 2011
[3] AusAID, 2007

(1993–2009). This is larger than the global average of 2.8–3.6 mm per year. This higher rate of rise may be partly related to natural fluctuations that take place year to year or decade to decade caused by phenomena such as the El Niño-Southern Oscillation.

Sea level will continue to rise in Vanuatu. Sea level is expected to continue to rise in Vanuatu. By 2030, under a high emissions scenario, this rise in sea level is projected to be in the range of 3-17 cm. The sea-level rise combined with natural year-to-year changes will increase the impact of storm surges and coastal flooding. As there is still much to learn, particularly how large ice sheets such as Antarctica and Greenland contribute to sea-level rise, scientists warn larger rises than currently predicted could be possible.

	2030 (cm)	2055 (cm)	2090 (cm)
Low emissions scenario	5–16	10–27	17–47
Medium emissions scenario	5–16	8–31	20–59
High emissions scenario	3–17	7–31	21–63

Project rates of Sea Level Rise in Vanuatu

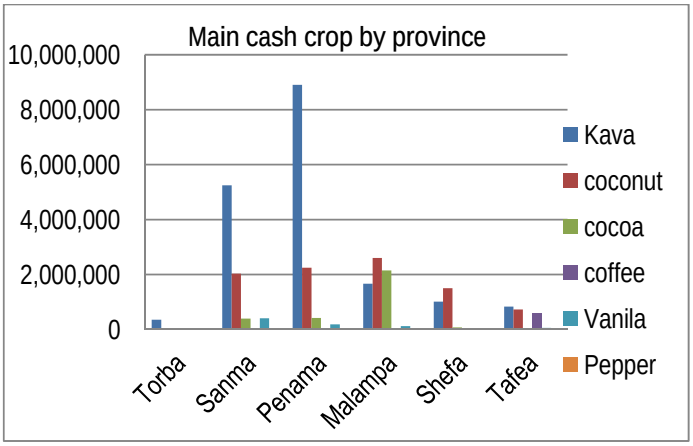
3.0 Agriculture in a Changing Climate

3.1 The Department of Agriculture & Rural Development (DARD) and its extension roles.

The Department of Agriculture and Rural development (DARD) is comprised of two main sections: the Technical section and the Extension service. The technical section is made of 10 staff while the extension has over thirty (30) staff comprised of the Provincial Agriculture officers (PAOs) and the assistant agriculture officers (AAOs). The broad objective of the Department is to build an agriculture sector that is robust and competitive through primary sector development that is based on sound policy, private sector development and empowerment of farmer through improved production, processing and marketing system. The DARD strives to achieve this objective through four (4) main programs areas which are i) Food crops ii) Agriculture information and marketing iii) Horticulture and iv) Commodities.

The National Agriculture census[4] provided information on some general aspects of the Agriculture sector production in Vanuatu including total crop gardening area, mean crop gardening area and mean gardens per household. The report disaggregates the statistics of crop production by Province, showing that Production by number of main cash crops differs from one island to another.

Graph showing Total number of the main cash crop by province



The DARD has an effective extension service linking technical information to farmers. The backbone of this extension mechanism are the Agriculture field officers (AAOs) who spend most of their time with the farmers in the rural areas where subsistence Agriculture is a

[4] VNSO; 2007

daily household activity. Agricultural extension is a process of sharing with and assisting the farming people to change their state of knowledge, skills, attitudes and values so as to improve their quality of living and become more self-reliant.

The DARD extension service role is to provide sound advice as well as transfer new ideas and technologies derived from research and trials and the know-how of this innovation to the farming community and the general public. The department collaborates together with the Vanuatu Agriculture research and training institute (VARTC) to carry out research.

DARD's information dissemination is grounded in the diffusion model of agricultural development, in which technologies are passed from VARTC or DARD Technical personnel via extension agents to farmers. Extension methods used include field days, short training activities (classroom type), farm visits and the other methods like harnessing lead farmers, farmer groups, agriculture cooperatives and associations.

The communication strategies are

i) **Method demonstration**- is when an agriculture extension officer demonstrates a method or technique to the farmers. For example, demonstrating a vegetative propagation technique of citrus by marcotting, budding or grafting or any other method that will see the field officer demonstrating while the farmer observes, take notes, asks questions or even does hands on practical exercises.

ii) **Field trials & demonstrations**- is when an agriculture extension officer works together with the farmer to undertake trials or even demonstrates a trialled technology found to be useful especially for other farmers to see and adopt it.

iii) **Printed information (leaflets/posters/news articles**- is the use of any form of printed materials to disseminate information. It is important that information is simplified to match the literacy level of the majority of the faming community.

iv) **Radio broadcast**- is the use of Agriculture Radio Programs to disseminate agricultural information. It also has some limitations especially in the islands where there is no reception of the local radio.

Within the extension services of DARD are the technical personnel who work in close collaboration with the Vanuatu Agriculture Research and technical centre (VARTC) to carry out research and trials in order to find new ways to address problems that have been

identified by farmers. Research for breeding new crop varieties and trialing out farming system practice as a resilient farming method during prolonged dry periods are a few examples of the research work that is being carried out by technical personnel of DARD and VARTC.

3.2 Observed impacts/opportunities of climate change in Agriculture

Increased temperature

Impacts (not exhaustive)

- Heat stress
- Crop failure
- Decreased productivity
- Pests/disease outbreaks

Sample Opportunities (not exhaustive)

- Geographical shift of crops planting locations. For example, Manioc and coconut can now be grown in high-latitude and cool climate areas of Middle bush, Tanna.
- Flowering and production of some fruit trees outside of season. Eg. Nakavika. Some of these trees are important local indicators. They indicate a calendar of activities for locals to follow throughout the year.
- There are other examples of latitudinal shifts and experiments done on southward shifts in species.

Increased precipitation

Impacts: (not exhaustive)

- Leaching of valuable soil nutrients
- Soil erosion
- Water logging of crops
- Pests/disease outbreaks
- Decrease production

- Invasion of weed species e.g. Broom weed

3.3 Understanding Crop Thresholds and sensitive varieties (Group activities)

This matrix is provided by Tari Molisale a root crop specialist from the Department of Agriculture and Rural Development (DARD) based in Santo. Thresholds are important in understanding the tolerance range of each crops during an ENSO event.

CROPS: Vulnerable to	Extreme rainfall	Prolong period of rain	Prolonged period of drought	Extreme temp	Comment
Yams - **Soft Yam**	No	sensitive	No	No	More than 3 months
- **Strong Yam**	No	Sensitive	No	No	More than 3 months
- **Wild Yam**	No	NO	No	No	Wild Adapted
- **Wailu**	No	Sensitive	No	No	More than 3 months affected
- **Bovele**	No	No	No	No	
Dry Land Taro (Colocassia)	No	sensitive	sensitive	no	More sensitive during the mature stage
Water Taro	No	No	Sensitive	No	
Taro Fiji	No	No	No	No	If exist 2 months
Navia	No	No	No	No	
Kumala (sweet potatoe)	No	Sensitive	Sensitive	No	
Banana	No	Sensitive	Sensitive	No	
Island Cabbage	No	Sensitive	Sensitive	No	Prolonged sun dead Prolonged rain dead
Cassava	No	Sensitive	Sensitive	No	

3.4 Building effective linkages with farmers to address climate change impacts in Agriculture

Effective linkages to addressing climate change impacts in Agriculture should be build around a network involving effective information exchange and interactions between the farmer, extension and research. This will enable extension agents to be able to identify and prioritized the main problems of the farmer caused by climate change. Then research work may be tailored to this particular problem in order to find ways and technology to overcome it.

Networking will Increase pressure on Research and Extension to find solutions that are more concretely targeted to the development needs of the farmer. Outputs of research will be more practically useful to the farmer to solve their problems. While much research has

been successfully carried out to date, it has been of limited use to the farming community because it does not necessarily address their true problems.

3.6 Policy Directives Challenges

Some of the climate challenges facing the agriculture sector may be addressed via the following policy options:

- Devise mechanisms that enable research, ensuing that results are produced fast enough to address emerging changing climate questions and needs
- Build the capacity of government and non government actors to implement basic on-farm climate resilient variety and farming system trials
- Revise or adapt agricultural communication materials to reflect climate change
- Revise duty statements and job descriptions of government officers where required to reflect changing roles in a changing climate
- Build the capacity of agriculture staff on climate change so that they may respond directly to farmer questions and issues
- Develop targeted and tailored climate change technical information for the farmer community
- Make climate tolerant crop varieties widely available

4.0 Livestock in a Changing Climate

4.1 Introduction

Raising and selling cattle, goats, sheep, pigs and other farm animals allows the people of Vanuatu to make daily subsistence living. However, livestock systems Vanuatu are changing rapidly in response to variety of drivers such as increasing population, urbanization and increasing local demand for livestock products. The increasing demand for livestock product is reflected in the 2010 total GDP of 10%. The potential impacts of these drivers of change on livestock system and the resource people who depend on them are considerable. These impacts will be manipulated by both supply-side shifts in natural resource use as well as changes associated with market led demands. Livestock (or crop-livestock) system in Vanuatu is complex, so it requires a mix of technological, policy (Priority Action Agenda (PAA)) and institutional innovations.

	Torba	Sanma	Penama	Malampa	Shefa	Tafea	Total
Cattle	2,729	91,830	22,284	16,082	21,868	19,344	174,137
Dogs	406	2,927	670	769	1,654	787	7,212
Goats	19	1,348	85	976	2,104	4,260	8,792
Horses	0	785	17	25	589	108	1,524
Pigs	2,934	9,645	24,210	15,763	14,765	21,378	88,679
Poultry	12,606	75,182	87,252	71,502	54,593	67,116	368,251
Sheep	0	293	0	0	1340	2	1653

Vanuatu Livestock statistic by province.

In addition to the drivers stated above, and remoteness of some islands and places, Vanuatu's climate is changing (consistent with global projections), and the climate variability and extreme climate/weather events mostly associated with ENSO events do have significant impacts on livestock systems. Droughts in Vanuatu are mostly coincided with El Niño, and its impacts on livestock are significant. For example during the remarkable and prolonged 1997/98 El Niño. Drought often leads to crop/pasture failure, livestock drinking water scarcity and temporary migration of livestock and

custodians. The most significant impacts of drought on livestock are; declines in productivity, loss in body weight and condition, reduced immunity levels (thus increased susceptibility to diseases), reduced reproductive efficiency, low fertility and productivity and reduce feed availability. Increase, variability and extremes of temperature also has impacts on Vanuatu's livestock systems.

4.2 Technical Knowledge on Climate and Livestock

There are many different types of drought. Two are of paramount importance to the livestock sector in Vanuatu: meteorological and hydrological droughts.

A meteorological drought lasts for about three months while a hydrological drought lasts for more than three months. Meteorological drought will have only slight impacts on the livestock industry in Vanuatu, requiring some adaptation in regards to shortage of feeds and fodder. In these cases, meteorological drought may lead to reduced productivity and a decrease in sale prices of animals. Reduction in feed availability may also lead to a decline in milk production, loss of body weight and condition, reduced immunity levels, increased susceptibility to diseases, reduced reproductive efficiency and low fertility.

Hydrological (prolonged) droughts have significant negative effects on livestock in Vanuatu. These impacts, such as reduction in productivity, increased physiological stress, decreased immunity levels, reduced reproductive efficiency, out-migration of animals and distress sale. High temperatures often coincide with drought, and also impact on livestock. It has been noted that high temperatures cause semen quality and quantity to decrease; one degree increase in temperature can reduce semen fertility by 10-15%. High temperature also leads to high livestock mortality rates, weight loss and dehydration that may result in less feed intake and decreased productivity. The combined effects of hydrological drought and high temperatures also affect farrowing, mating, restockers/fatteners, barging of cattle and operation of provincial butcheries.

4.3 Question & Discussion

The forum provided an avenue for interaction discussion between Vanuatu's livestock experts and participants from other sectors. Questions were raised mainly about preparation before and intervention during extreme weather/climate events. For instance, if flooding is predicted, what are the options for farmers? Experts suggested transport of animals to higher ground, well in advance of extreme wet weather, with the help of seasonal forecasts.

With regards to droughts, questions were raised such as; where and how to plant pastures to minimize water stress? What are the ideal breeds to cope with drought? How much does a bull need to consume during drought? According to the experts, to minimize impacts of drought, it is better for farmers to plant pastures in fields where there is at least 70% sunlight. Farmers should also use feed supplements such as tucker and copra leftovers (makas). According to livestock officers, a bull consumes about 50kg of pasture a day, so it is important for farmers to avoid overstocking of a paddock during drought times when feed is less abundant. The stocking rate stated was 2.4 cattle per hectare, and that elephant grass should made available for cattle.

Drought can also lead to low productivity, so the meeting was informed that the best breed for rural farmers are mixes between Brahman and local breeds as they will always perform best during drought, as other breeds require extensive management. Question were also raised about high mortality of cattle during the 1997/98 El Niño as experienced by the South Santo Cattle project. The issue of management including insufficient feed and grazing areas and no rotation of cattle led to a build up of worms in the digestive system. Thus it was worm infestation that most affected the cattle during this particular drought, and that management could have minimized much of the mortality experienced. Importantly however, no irrigation system was in place during that drought, and it was suggested that pastures be planted with some kind of irrigation. Ultimately the lifespan and health of cattle depends on how much a farmer manages his/her paddocks, and that management is simplified (and adaptation to extremes strengthened) when farmers blend agriculture, forestry and livestock. Two additional adaptation options were discussed, including artificial insemination, and more regular information exchange between farmers and the private sector (SAPV/FSA).

4.4 Strategies for Adaptation

There are hundreds of possible adaptation strategies for the Vanuatu livestock industry, broadly categorized as technological (such as more drought tolerant crops and pasture), behavioral (such as changes in dietary preferences) and managerial (such as different farm management practices). A few examples include (see the draft National CC Adaptation Strategy for a much more comprehensive list)

- Micro-level adaptation options, for example, diversification and intensification of crops and livestock production
- Changing land use and irrigation
- Altering the timing of operation

- Income related response such as flood, livestock and crop insurance scheme, credit scheme, and income diversification opportunities
- Development and promotion of new crop varieties and livestock feed, improvement in water and soil management, and improve animal health technology
- Utilize locally available feed resources
- Link farmers with existing market options
- Cooling off and sun bathing

4.5 Process-mechanism-structures

The issues associated with livestock adaptation options are really no different to other sectors, whether in risk management or climate proofing frameworks. Decisions have to be made where to target activities, which options to assess, test and implement, and how to identify the appropriate entry points into the system. Vanuatu can learn from other countries and carry out impact assessment and trade-off analyses, as well as develop its own tools and database for effective monitoring.

Vanuatu can also learn from the experiences of other countries regarding assessment of biofuels: where and how can they contribute to alleviation of poverty from livestock waste, and what are the key trades-offs in biofuels versus conservation agriculture and soil fertility management? It is also important to share data with other regional countries, so that potential areas for improvement can also be identified.

4.6 Policy direction/directive

The workshop discussed some policy directive for the Vanuatu livestock sector and these have been summarize as follows:

- Institutional changes, including pricing adjustment such as subsidies.
- Development of income stabilization options
- Insurance programs
- Improvement in local/inter-island livestock markets
- Broaden the range of animal genetic resources
- Generate information that can be distilled to help people make decisions
- Identify thresholds in natural systems beyond which adaptation maybe extremely difficult or impossible

- Improve communication about climate uncertainty and how uncertainty can be better addressed in the future, without causing decision paralysis.
- Strengthen and mainstream climate considerations into meat industry regulations 12 of 1994

5.0 Quarantine in a Changing Climate

5.1 The roles and responsibility of Quarantine Department

Climate change is expected to substantially alter the nation's biodiversity, causing changes in genetic composition, and species ranges, and affecting species interactions and ecosystem processes. The protection of Vanuatu's biodiversity, especially the native floras and fauna, from pests and diseases provides a great challenge for any institution given the challenges of border control and unimpeded flow of plants and animals throughout the scattered islands of Vanuatu. Coupled with the impacts of climate change in this sector, authorities face a substantial burden to devise coping mechanisms to safeguard Vanuatu's biodiversity.

Past and current governments have placed considerable emphasis on climate change issues including it in its recent reviewed planning long acting short (PLAS) policy. It recognizes that climate change is a cross-cutting issue, directly and indirectly affecting all government sectors. The Vanuatu and Meteorology and Geo-hazards Department (VMGD) is responsible for collecting and disseminating climate information has taken the leading role in ensuring that this issue is incorporated into planning and policy of the land-base sectors such as Quarantine, Agriculture, Livestock and Forestry. This Santo summit has provided the VQIS with options and training on how it can effectively utilize the VMGD products and services (especially seasonal forecasting) with the believe that addressing impacts of climate variability in the short term can help tackle the impacts of long-term climate change .

5.2 Technical knowledge

The impact of climate change in land-based sectors is not a new issue and very recently the Vanuatu Quarantine Department has included it into their planning. One of the main concerns of the department is the impact of climate change on the migration of pest and diseases, newly introduced or existing, but expanding their ranges quickly into newly climate-suitable habitats. This climate-enabled migration has increased the economic and environmental costs of containing infestations, all the while in landscapes that do not general high economic returns and with little opportunity to recover costs. The eradication response is not economical in a country with small economic -base like Vanuatu. Therefore controlling the introduction and spread of pest and disease population is a main priority.

In the recent climate change science report (2011), there is moderate confidence that Vanuatu will be wetter in the wet periods. Periods of prolonged rain and humidity during the wet season can provide favorable conditions for plants/crops diseases to occur and proliferate. In such climate conditions, diseases such as phytophtora palmivora (cocoa black pod disease) have already begun affecting cocoa plants and reducing yield.

The increase in rainfall can also affect human diets indirectly. Plentiful rainfall favors the growth of fusarium spp (Wilt diseases) that can affect mainly vegetables (tomatoes). With climate-induced infections, specialty products are becoming more expensive and affecting the health of the general public, especially those residing in urban centers.

In addition to diseases, pests can also be prevalent during periods of high rainfall. The two main seasons (wet and dry) in Vanuatu provide ideal condition for insect pests to occur and proliferate. Rainfall after periods of drought often causes locally dormant pests and diseases to become active. Examples include the leaf chewing and sucking insects (*tarophagus proserpina, Giant African snail, Graffea crouani* (coconut stick insect) , leaf mining insects , invasive ants, quadrastichus erythrinae (Erythrina gall wasp) and the puccinia heliconiae (Leaf lap-lap rust) that is now found in almost every island. Several climate-enabled insect affect nationally important cash crops such as the promeccotheca spp. (Coconut leaf miner).

Several foreign introductions may have been climate-related, including the spiralling white Fly (Aleurodicus dispersus) which is now found in many islands in Vanuatu. And very recently Varroa mites were discovered to have made an incursion on Efate. These few examples emphasize the need to have coping and adaptation mechanism in place to cater for such situations.

5.3 Q&A (Discussion)

Questions raised during the summit revolved around how introduced climate resilient crop and animal species are able to deal with Vanuatu's existing complement of pests and diseases, and what additional damage to flora and fauna they may cause? There was consensus to select and introduce species which have already been used by many other countries, and which has only specific breeding options, to ensure that whatever crops, animals or microbes are introduces are safe.

Vanuatu's Narara tree is currently dying out around Vanuatu due to the intended introduction of a species of wasp (Quadrastichus erythrinae (Erythrina gall wasp) that control's citrus moths. This tree is a traditional indicator used by islands to determine the appropriate time for planting of certain crops and harvesting of certain sea foods. Discussions revolved around mechanisms that can be use to prevent this tree species from extinction. While this parasitic wasp is regional problem, the Vanuatu's quarantine and inspection services has the capacity to deal with it. However, there is the issue of funding.

5.4 Strategies/Actions

These are hundreds of possible solutions and adaptation strategies for minimizing climate-related pests and diseases proliferation in Vanuatu.

- Climate Change adaptation strategies include:
    - Diversity of crops cultivated
    - Select new (and traditional) resistant varieties to pests and disease
    - Develop new farming techniques
    - Use organic and traditional knowledge means of controlling pests and disease
    - Use biological control method of pests
    - Strengthen Quarantine border control

- Facilitate the importation of plants and animals species that are resistant to adverse climatic conditions.
- Develop more research trials on pests and disease management

5.5 Processes-Mechanism-Structures

One of the main mechanisms to combat impacts of climate change in regards to pests and disease is to ensure that introduced species are well documented so we can learn from experiences and practice. In other words, Vanuatu can adopt the success stories from other countries. Vanuatu's Quarantine service needs to be well connected with regional organizations like the Secretariat of the Pacific Community (SPC) to support our national response to pest and disease problems. The regional organizations current research capacities are and will continue to be of great benefit to member countries. There is also need to share data on regionally problematic species, success stories, management plans, and eradication efforts activities that can help determine management approaches and disseminate techniques.

5.7 Quarantine Policy Directives

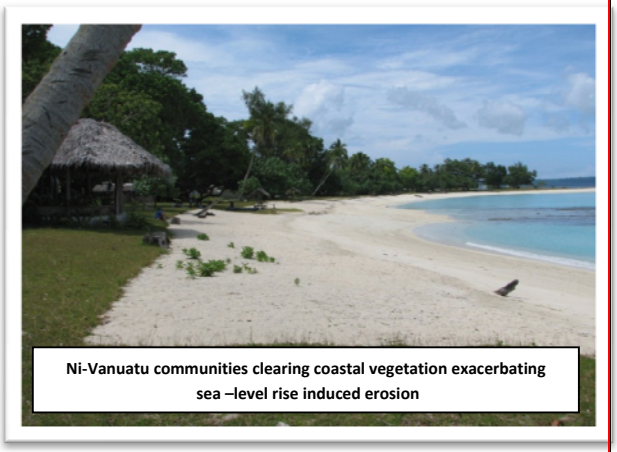
The summit discussed policy options that may support the quarantine sector adapt to climate change including:

1. Integrating traditional and scientific knowledge on pest and disease control
2. Develop mechanisms that promote cooperation and collaboration among agencies that have a role in pest and disease control, border control and quarantine issues
3. Diversify crops and farming techniques
4. Undertake local crop, pest and disease research

6.0 Coastal Erosion Control through Forestry

6.1 Introduction

Projected global-warming induced sea level rises of 6.5mm per year (combined with the storm surges, pressure-related tidal fluctuations, unsustainable mining[5] and clearing of beaches and geological/tectonic subsidence) are threatening and eroding Vanuatu's coastlines. Coastal forestry has been identified in key national documents as a climate change risk reducing strategy. The most common cause of coastal erosion is historic destruction of natural and highly specialized salt-tolerant pioneer beach/dune-building plants. This problem is often seen in coastal areas where the specter of erosion has, or is creating harmful erosion impacts.



Ni-Vanuatu communities clearing coastal vegetation exacerbating sea –level rise induced erosion

The most likely causes for the almost complete removal of spinifex (and other dune-building plants) are domestic pigs, cattle and goats, introduced to Vanuatu centuries ago. These animals readily graze the above-ground foliage and disturb the vital runners of this and other dune-building plants, rapidly destroying their critical coastal protective functions. Loss of these species tips the 'Cut & Fill' cycles to favor beach erosion.

According to Vanuatu's **National Adaptation Programme for Action (NAPA),** "forests have always been an integral part of lives of the people of Vanuatu. Within the household, the forests have always provided timber, posts, thatch, food, fuel-wood and traditional medicine. Environmentally, forests and trees act as soil and water protectors, and shelter from sun, rain and wind." Sustainable forest management was selected as a key adaptation focus for climate change at the national level.

According to Vanuatu's **Priority Action Agenda,** "The main priority is to create an environment for private sector led economic growth, including activities in the primary sectors of agriculture, forestry and fisheries, as well as in tourism." Section 6.1.2.3 outlines the importance of forestry for economic development and environmental sustainability, and highlights the priority to "Maintain

[5] Removal of coastal coral based sediments (kirikiri) for decorative or construction purposes causes severely negative impacts on sensitive beach systems. Where this activity is currently being undertaken, it should be strongly regulated or cease entirely, and community education and beach protection awareness should be initiated.

and improve the regulatory and management framework for the sustainable development of the sector".

The Climate Change Adaptation section of Vanuatu's **National Forest Policy**, highlights the following Policy Directives:

- *Develop forestry-related CC adaptation demonstration projects including concerns for food security, soil stabilization, water management, and coastal erosion.*
- *Introduce and promote climate change resilient tree species and varieties*
- *Undertake ground cover initiatives to prevent soil and coastal erosion*
- *Identify and seek financing for novel and promising forestry adaptation projects and programs*
- *Train all stakeholders on the opportunities for climate change adaptation and impact assessment*
- *Rehabilitate watershed and water catchment areas to secure water supplies Systematically assess Minimize wind damage to crops and infrastructure by trialing windbreak species and systems*

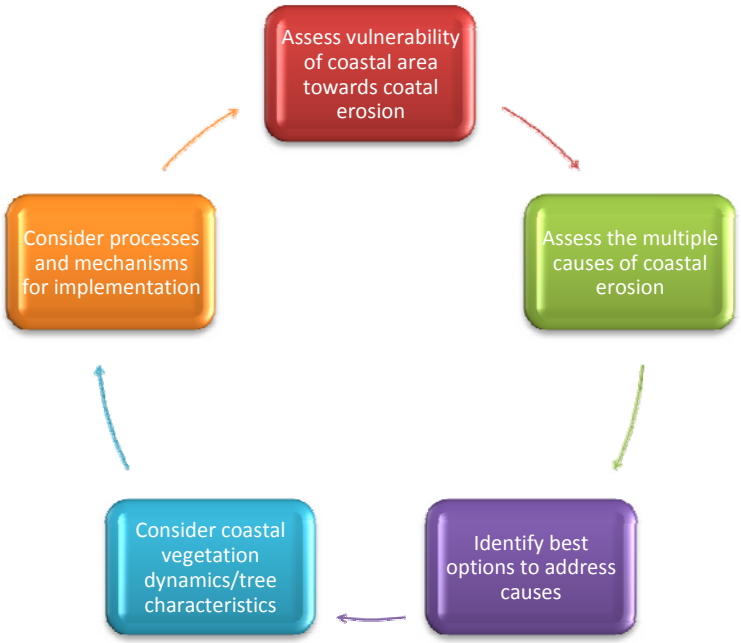
The IPCC[6] suggests that adaptive responses to sea level rise can be broadly categorized to include **"Retreat"** wherein no effort is expended to protect the land from the sea, the coastal zone is abandoned and ecosystems shift landward (the case of Tegua, Torres Islands), **"Accommodation"** wherein people continue to use the land at risk but do not attempt to prevent the land from being flooded, including the use of erecting emergency flood shelters, elevating buildings (the case of Penorou, West Coast Santo), or growing flood or salt tolerant crops, and **"Protection",** involving hard or soft structures such as sea walls (the case of Unakap, North Efate) or beach vegetation restoration to protect the land from the sea so that existing land uses can continue. In Vanuatu, the soft protection option of coastal vegetation rehabilitation has been little discussed or trialed, although successes and challenges have been well documented in the Pacific region.

6.2 National Guidelines for Addressing Coastal Erosion through Forestry

The National Government, through the Department of Forests, has been mandated to lead efforts for erosion control through forestry. The Department is supported by the coordinated work of individuals, communities, civil society groups (including NGOs and Churches), development partners, academia and the private sector. There are five steps that should be taken in the process of

[6] Strategies for Adaption to Sea Level Rise, November 1990. Intergovernmental Panel on Climate Change, Response Strategies Working Group.

controlling erosion through forestry. Following these five steps may lead towards a forestry-based solution to coastal erosion issues in Vanuatu.



1. Assessing Coastal Erosion Vulnerability of Coastal Areas

In the first instance it is important to assess vulnerability by examining the following ecosystem/site characteristics:

- Exposure to winds and waves.
- Type of soil, sand, coral, substrate
- Extent of existing erosion or coastal damage
- Vegetation type, condition and age.
- Biodiversity.
- Tectonic movement
- Coastal activity, land use and development

2. Assess Cause of Coastal Erosion.

Next it is critical to examine the root causes of coastal erosion in a particular site. While some causes may not be immediately obvious, a quick evaluation using the following criteria may help

isolate one or two priority areas of erosion focus. Consider activities/infrastructure/processes which:

- Include the removal, clearance, death or alteration of coastal vegetation
- Convert endemic or native vegetation systems into other vegetation types.
- May hinder or preclude natural coastal processes rehabilitation with the type of coastal vegetation on site.
- Include activities which directly remove sand o substrate
- Exacerbate rising sea level, including global warming induced sea level rise or tectonic subsidence
- Increase exposure to winds and waves.
- Include drainage, or other water flow and outage.

3. Identify Best Option(s) to address Coastal Rehabilitation

There are many options for proceeding with coastal rehabilitation to control erosion. Each is associated with differential costs (labor, resources, time) and benefits. In general we can implement on ground activities or promote erosion control through policy options and market incentives. Some forestry related options include

- Protecting coastal habitats for biodiversity (flora and fauna) which may hold climate tolerant genetic material and processes
- Rehabilitation/Enrichment planting of valuable Coastal timber tree species including Natapoa, Natora, Nambakura Sandalwood etc.
- Rehabilitate beaches with salt tolerant, well-rooted grasses and shrubs to hold sand in place
- Protect coastal habitats for food security and as a source of crabs, birds, nuts, fruits, wild yams etc.
- Replant coastal vegetation for community recreational and cultural use (rest areas, collection of medicinal plants and flowers).
- Implement integrated planning, conservation, management and development in the coastal zone (e.g Eco-tourism).
- Protect coastal vegetation that may provide services as Shelter belts/Wind breaks.
- Demarcation of Buffer zones.
- Fencing to protect vegetation rehabilitation work
- Establish coastal species nurseries

4. Understand coastal ecosystem dynamics and species characteristics.

Coastal rehabilitation will require an in-depth understanding of the ecosystem and species to be rehabilitated. Each tree species has a fixed environmental tolerance range that cannot be exceeded. Ecosystem processes can be stretched to accommodate new species and components, but only to a limit. Before rehabilitation commences it is important to:

- Identify the current and historical vegetation of the erosion target site
- Study the plant associations and any symbiotic or mutualistic interactions that may be present.
- Identify the ecosystemic function of the plant species present (and those to be introduced) considering factors such as soil conservation, soil stability, wind break potential, water storage, shade tolerance and potential, habitat complexity, establishment robustness).
- Identify tree/plant species that may be of multiple use (food, soil stability, timber etc)
- Identify Coastal Site Capture plant species including; Climbers, Shrubs and Higher plants.

5. Develop mechanisms and processes for implementation

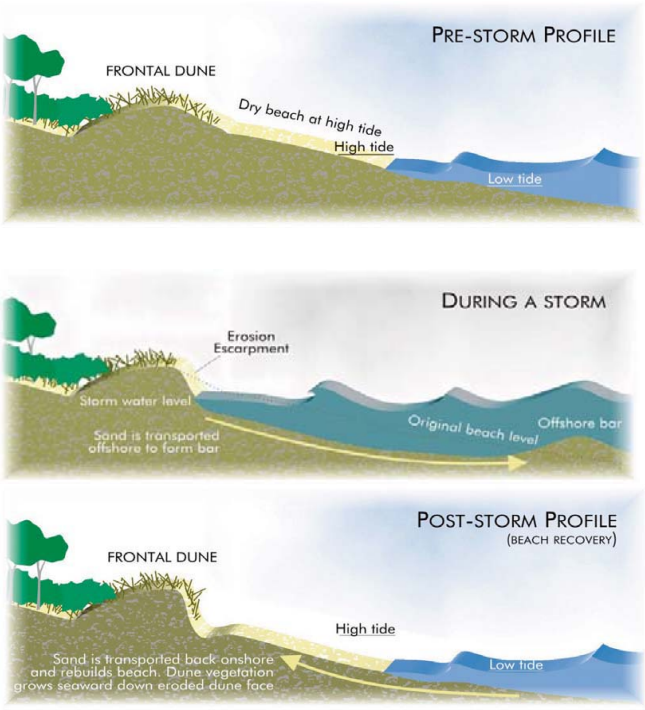
Once suitable options for erosion control through forestry have been identified, it is important to identify processes and mechanisms whereby actions can be implemented, maintained and supported by stakeholders. These options may include:

- Community Awareness.
- Establishment of implementation/governance committees (with respected Elders/leaders)
- Establishment of a network of groups (especially people living along the coast).
- Planning and development of a Program of Activities (including special events like tree planting days, site visits and field days)
- Establishment of PSPs to assess performance of Coastal Rehabilitation
- Link coastal forestry activities within the workplans of the DoF, DARD, DoL and other relevant authorities, particularly in the area of monitoring and reporting.

6.3 Soft Protection Measures: Re-vegetation and Forestry

According to Greg Jenks (ClimSystems), foreign plants (like marram and lupins) were introduced to New Zealand to hold eroding sand in place, but they proved less effective than native dune plants. Storm erosion subsequently became more severe. There was a prevailing misconception coastal erosion is due to long-shore (or littoral) sand drift following removal off the beach by storms. That is to say that sand moves off the beach, along the coast and away from its original site. The popular belief was that once removed, the sand would be "lost".

Storm events are a natural part of Pacific Island climate, and each storm event may take (or replace) a large amount of sand from coastal areas. However, contrary to popular belief, scientists now agree that sand removed from beached simply sits on offshore bars and within lagoons until tides, waves and wind eventually put them back on beaches. This process is called the "Cut and fill" beach cycle. Beaches erode when there is nothing to hold the sand in place on the shoreline, however the sand is not "lost" but rather "waiting" just offshore for natural onshore transfer processes.



It is now apparent that cross-shore exchange is the dominant coastal process, by at least an order of magnitude (i.e. 10x or more common). In Vanuatu, much of the sand that has been eroded off beaches just resides in lagoons, waiting for the right conditions to be trapped in the beach vegetation again – where it belongs.

Simple restoration of the indigenous beach plants allows sand from offshore reserves to be trapped in place as it is continuously delivered by 'cross-shore exchange' processes. After each onshore storm event, fresh, porous sand is delivered to the beach and held in place by specialized beach vegetation, thereby increasing the WIDTH of dunes AND beach.


Port Orly, Santo Island

The trapping of sand onto the beach system will also reduce smothering coral beds by beach sediment. This has been identified as one of the causes of coral decline on the Great Barrier Reef in Australia. Healthy coral reef systems are a reliable and constant source of sand for consequent formation of beaches. As much as 90 per cent of the coral reef skeletons eventually dissipate, forming sand[7].

Not only has controlling coastal erosion through soft protection measures been proven successful, it is also very cost effective. The table below compares the direct costs, maintenance requirements and beach impacts of vegetation rehabilitation versus seawalls. By implementing soft protection, individuals, communities and governments can save hundreds of thousands of vatu in costly investments.

	Direct Costs	**Maintenance Requirements**	**Impact on Beach**
Dune replanting programme with community input.	VT1000-4000 per linear meter	Minimal; perhaps some targeted fertiliser for one or two subsequent years.	Dune and beach increase in width, improving recreation, amenity and function of the improving dune buffer.

[7] National Geographic May 2011

Seawalls and revetments.	VT1500-480,000 per linear meter.	Expensive maintenance or full rebuild required every 20–40 years	Beach continues to erode, reducing or destroying public access and recreational use.

Working together with a common goal, management agencies and caring community members in New Zealand have taken many local beach systems from disaster to restoration. The programme partners are now funding one hundred thousand native dune plants each year, with a total over 1,000,000 plants (equivalent to about 140km of front-dunes), all planted by community volunteers. The restored beaches provide improved protection from tsunami, storm surge inundation, and coastal erosion[8], and all of the restored sites are show a significant trend of accretion, despite climatic conditions favoring erosion. In fact, the measured rates of accretion are an order of magnitude larger than would be required to adapt to event the worst IPCC sea level rise predictions.

Important lessons can be learned from the New Zealand experience:

- The scale of rehabilitation work is immense, any one group, community, ministry, or agency cannot tackle it alone.
- Success can be achieved through *strong and effective partnerships* with passionate members of the affected communities.
- Public knowledge of the scope for restoration is an important first step.
- Many people still believe the poor condition of their beaches is natural or normal, and something that cannot easily be solved. The eroded state of beaches/dunes has been their lifetime experience, and so many people have no reference point to judge the immensity of the change or the losses. “It all happened so long ago…”

Some recommendations for community engagement in revegetation:

- Group members make decisions about the plants and materials required for projects, which are made available through supply by the programme partners. (Providing materials in this manner avoids excessive bureaucracy and the auditing that might be necessary if funds alone were supplied.)

[8] de Lange, Jenks 2007. Effectiveness of dune restoration for the management of coastal hazards and biodiversity, NZ Coastal Society Conference, Tauranga.

- Signs about beach restoration are prominently displayed at restoration sites (helps people realise that enhanced dune stability is a result of volunteer works, and that everyone can help achieve these goals.)
- Frequent positive media stories (highlight community empowerment and participation)provide good public information about beach restoration activities and objectives
- Programmes should be operated by and through local community members taking an active role in managing their own beaches, i.e. local solutions for local problems.
- Groups decide the way in which they wish to operate, including whether or not to have formal structures like committees.

Recommended next steps to begin the beach vegetation process in Vanuatu

- identify & obtain suitable plant propagation material
- initiate suitable nursery production of restoration plants
- initiate community care groups to lead the restoration process
- establish community awareness programmes to ensure sustainable responses
- ensure empowerment of communities, and acceptance of the problem and solutions (i.e. local problems need local solutions!).
- take lots of photographs, and measure to celebrate your successes!!
- *"We live in a world of uncertainty. If we slavishly waited for certainty we would never make any decisions…"* – so it's important to commence solutions NOW!!

6.3 Selecting appropriate beach rehabilitation species

Once a target rehabilitation area has been identified, it is important to choose the vegetation species that will be used.

FOREDUNE ZONE (or front beach):

The most effective sand trapping pioneer beach plant in the Pacific region is the salt-tolerant Spinifex. Spinifex is one of the most aggressive pioneer species in the world and rhizomes have been recorded growing 20m in a three-month period[9]. There are differing species of this plant that are endemic to different areas of the vast Pacific region, but the species native to tropical Vanuatu is

[9] P. Hesp pers. comm.

Spinifex littore*us*[10]**.** Their leaf system is more typical of xerophytes (i.e. stiff, prickly foliage). This is a pan-pacific salt-tolerant pioneer grass species found at the vegetation line on sandy beaches near the sea. It produces roots at the leaf nodes that aid in stabilizing beach sands. The sparse leaf growth slows sand-carrying wind so that the sediment drops out of the flow and builds up beach height.

Spinifex

Purple Beach Bean - *Canavalia rosea*. Occurs all over the world in tropical and subtropical coastal locations. It prefers warmth and can tolerate periods of drought. The 'purple beach bean' is an excellent pioneer species on sandy beaches, dunes, and coastal scrub. It readily sets down roots at the nodes as it trails across beaches and dunes, the roots forming networks that aid in stabilizing sands. It is highly salt-tolerant and prefers sandy soils. Culture: full sun, light shade.

Purple Beach Bean

[10] Note that Spinifex is a nitrogen-demanding plant, and so they benefit greatly by having nitrogen fixing species (like the 2 beach beans) planted nearby to keep it growing vigorously. These indigenous salt-tolerant plants also have a preference for alkaline conditions.

Yellow Beach Bean – *Vigna marina*. This species is salt-tolerant and is found on tropical beaches around the world, such as those in Vanuatu and on various other islands in the Pacific Ocean. *Vigna marina* grows at the vegetation line on sandy beaches, frontal dunes, and beach ridges near the seashore. The two beach bean species (above) will provide natural nitrogen to boost growth of spinifex.


Yellow Beach Bean

Beach Morning Glory - *Ipomoea pes-caprae.* A common pan-tropical creeping vine in the Convolvulaceae family. It grows on the upper parts of beaches and endures salt air. It is one of the most common and most widely distributed salt-tolerant plants and provides one of the best known examples of oceanic dispersal. Its seeds float and are unaffected by salt water. This plant also readily sets down roots at the nodes as it trails across beaches and dunes, trapping sand as they roam.


Beach Morning Glory

MID-DUNE ZONE (or back beach):

Beach vitex - *Vitex rotundifolia* - a species of *Vitex* that is native to seashores throughout the Pacific. This woody perennial plant typically grows approximately 1 m in height. It has a sprawling growth habit and produces runners that root regularly at nodes. This rooting pattern allows the plant to spread rapidly. At maturity, *V. rotundifolia* produces blue-purple flowers that are borne in clusters and ultimately yield small brown-black fruits. Its leaves are rounded at the tips with green upper surfaces and silver lower surfaces. While the plant is a seashore obligate, it grows over a wide

latitude range. *V. rotundifolia* is highly tolerant of the harsh beach dune environment characterized by intense heat, high wind, coarse-textured soil, and elevated salinity.

Planting methods are very important. The normal spacing is 2-3m between each plant. The most effective way to combine community harmony and beach protection is to plant modest areas of the beach (small circles work well), as this permits good access to the sea for people and livestock while also protecting your plants.

The species should be mixed to duplicate the natural growth habits and patterns, but please avoid planting in straight lines. Please make sure the plants are placed into deep holes (past the top of the potting mix) while leaving a depression around the top to encourage rain water soakage around the plants. Add about 30g (a small handful) of controlled release fertilizer to the bottom of each planting hole to boost early growth[11]. The best time for planting is January and February (the rainy season), no later or earlier.

[11] For further information, please read the Planting Info Sheet in the Appendices.

6.4 Protecting Newly Planted Beach Vegetation

Planting efforts may be undermined quickly due to damage caused by wandering livestock. Your plants can be protected in a number of ways, but most importantly they must be kept free of grazing damage. Whether you use inexpensive electric fences, or more traditional timber/or bamboo corrals, the result must be the same – reliable and effective protection.

6.5 Coastal Rehabilitation through Mangroves

While many of Vanuatu's islands are ringed by volcanic coasts, some areas posses the right environmental estuarine conditions to harbor mangrove forests. Vanuatu has a total of 14 species of mangroves and one *Rhizophora* hybrid confirmed by the Vanuatu Cultural Centre[12] in 2010. The most common species of mangrove in Vanuatu belong to the genus Rhizophora.

Figure 1. Area Distribution of the Main mangroves in Vanuatu Archipelago

Island	*Area of Mangrove (%)*		*Area of Island (%)*	
Malekula	1,975	(78.0)	205,300	(1.0)
Hiu	210	(9.0)	5,280	(4.0)
Efate	10	(4.0)	92,300	(0.1)
Emae	70	(3.0)	3,280	(2.1)
Epi	60	(3.0)	44,500	(0.1)
Vanualava	35	(2.0)	33,100	(0.1)
Ureparapara	30	(1.0)	3,900	(0.8)
Motalava	25	(1.0)	3,100	(0.8)
Aniwa	15	(0.5)	800	(1.9)
Total	*2,460*		*391,560*	*(0.6)*

Source: David and Cilaurren 1988.

Generally, mangrove forests largely grow adjacent to mudflats, tidal lagoons, salt marshes, rivers, and streams. They follow different zonation patterns at different sites, and show a wide range of environmental adaptability characteristics[13].

[12] Hickey 2010

[13] Lal et al, (2010), Mangrove ecosystem management in Vanuatu an overview, MESCAL,6-10

Mangroves constitute a biologically rich ecosystem which is home and nursery to a large variety of bird, reptile, fish, crab, shrimp, and mollusk species. Endangered dugongs feed on mangrove-associated sea grass species and the mangroves themselves provide a nectar source for bats and honeybees. Mangroves are among the most productive and biologically complex ecosystems on Earth.

It has been shown by recent studies that Mangroves are an effective store of atmospheric carbon, in all parts of the plant from the leaves down to the roots system. Mangroves are among the most carbon rich forest types on the planet. Mangroves are also of climate relevance for the role they play in physical shoreline protection and food/material security.

In 2010, a trial for Mangrove rehabilitation and climate change erosion control was initiated on Efate Island by DEPC/ MESCAL, SPC-GIZ & the Department of Forests. The roots systems of many mangrove species are complex, and therefore posses an unmatched ability to stabilize coastal zones. The species selected for the coastal rehabilitation trial were *Sonneratia sp and Avicennia Sp.* The trial had as its primary objectives: 1. Restoration of area mangrove forests 2. Prevention of coastal erosion 3. Increased production of marine fauna & flora 4. Trial a coastal protection and adaptation measure to combat climate change and 5. Provide habitat for a diverse marine and terrestrial flora and fauna. The methodology included collection of seeds and planting in various nursery/field sites to deduce seedling mortality in a changing climatic context.

Seeds grow well in high soil fertility, Nursery planted seedlings grow faster than wildings, Wildings, although growing slow, eventually perform very well. Growth and survivorship is good in sandy soil, under a mix of shade and open canopy. Some seeds inevitably die due to insect infestation. Various factors were assessed during the trial including Soil PH, water salinity, pest infestation, seed growth rate, and germination timing. Damage to young plants can be caused by:

- Tidal surges and storms physically uprooting trees
- Barnacles and other arthropods attaching to young seedlings, interfering with respiration, photosynthesis and delaying seedling growth.
- Land crabs and gastropods feed on and damage young plants
- Insect pests such as wood borers, caterpillars, and beetles feed on and damage the leaves.
- Increased amount of sediment in rivers due to inland deforestation
- Effluent pollution, plastics, empty cans etc
- Changes to the water salinity level (if salinity becomes too high, mangroves cannot survive.)

In summary the research trial suggest that mangroves must be encouraged in communities as a best practice coastal erosion and sea level rise adaptation measure. This type of adaptation is most cost effective and engenders self sufficiency as we are able to combat the impacts of climate change without requiring external funding. Replication of mangrove rehabilitation will require the development of a standard planting and monitoring methodology. With mangrove initiatives, traditional knowledge and local resources can be tapped to adapt to climate change.

6.6 Coastal Forest Rehabilitation by Communities with NGO support: the Red Cross Experience

Most people in Vanuatu depend on forests to provide essential goods and services such as Food, Shelter, material Security, Soil, Water Conservation, flora and fauna habitat, Income Generation, Cultural Identity and Spiritual Well-being. The greatest challenge in Vanuatu is finding ways to balance and reconcile conflicting and increasing demands from those who depend on one or more of these aspects for their survival.

In coastal ni-Vanuatu communities, many factors are influencing coastal erosion: Storm surge, Coastal Inundation and Flooding, Sand mining, Logging activities, Population growth, Tourism and other development activities. The impacts of the factors are many, including on Marine Resources (poison fish), Coastal Erosion, Coastal Inundation and Flooding, endangerment of Heritage sites (burial site, family history for example in Mosina, Vureas Bay, Nereningman, Queremagde), decline in biodiversity (crabs etc), loss of wind breaks, decline in quality and quantity of topsoil, relocation of homes and villages.

At present ni-Vanuatu communities are constrained in the technical information they receive about coastal rehabilitation. Most communities that are engaged in coastal rehabilitation are doing so without expert advice, and follow a common sense local approach which often includes, using local species that seem to already grow well in the area, use local planting methods as used in the garden with minimal tools, combine replanting efforts with conservation areas and conservation zones, and get some support of materials and finance from locally active NGOs.

Alongside this local approach comes many challenges, namely that without proper advice, many conservation and rehabilitation efforts garner low success. The reasons for such low success rates include little follow-up and maintenance after replanting, use of poor quality of seeds/planting materials, use of inappropriate species for the coastal zone, unsuitable site selection, lack of

community technical skills, community overburdening with prior commitments and other climate change projects.

Some of the key activities that have been trialed by local NGOs at the community level regarding coastal erosion control include: mangrove replanting, coastal reforestation, marine and land conservation zone, environmental awareness, small grants and funding support, technical support. Some of the key messages shared with communities include: sea level rise science/causes, possibilities for coastal home relocation, decrease in logging activities, proper management of tourism activities, use and capacity of underground wells, changes to ecosystems, degradation of rainforests and socio-economic approaches to adaptation.

6.7 Coastal Re vegetation Summary

Vanuatu's policy environment clearly promotes adaptation to climate change ad coastal erosion through a range of soft and hard measures. While some communities have approached coastal erosion through the construction of sea walls and other physical barriers, it is much more cost effective and appropriate to utilize coastal rehabilitation through mangrove and dune enhancement and protection. The results of such coastal rehabilitation, while not yet trialed on a large scale in Vanuatu, have been impressive throughout the region. Methods and approaches for coastal erosion control have been developed and are being tested by a variety of agencies including government, civil society and academia. Most communities would like to expand their participation in coastal erosion control measures, but require more technical expertise on the issue from all partners.

6.8 Proposed Policy Options

- Eliminate the drivers and causal factors that lead to the widespread destruction of natural and highly specialized salt-tolerant pioneer beach/dune-building plants.
- Develop forestry-related CC adaptation demonstration projects including concerns for food security, soil stabilization, water management, and coastal erosion.
- Introduce and promote climate change resilient tree species and varieties
- Undertake ground cover initiatives to prevent soil and coastal erosion
- Identify and seek financing for novel and promising forestry adaptation projects and programs
- Train all stakeholders on the opportunities for climate change adaptation and impact assessment

- Rehabilitate watershed and water catchment areas to secure water supplies
- Systematically assess Minimize wind damage to crops and infrastructure by trialing windbreak species and systems
- Further develop soft protection options of coastal vegetation rehabilitation in Vanuatu
- Consider coastal erosion an integrated problem that includes multiple human and non human contributing factors in addition to sea level rise and climate change.
- Link coastal forestry activities within the workplans of the DoF, DARD, DoL and other relevant authorities, particularly in the area of monitoring and reporting.
- Develop coastal rehabilitation programmes that are operated by and through local community members taking an active role in managing their own beaches, i.e. local solutions for local problems.
- Protect and rehabilitate sensitive mangrove areas.
- Ensure that communities and NGOs are implementing coastal rehabilitation projects with the most up to date and scientifically sound technical advice.

7.0 Traditional Knowledge and Climate

7.1 Biodiversity as Climate Indicators

There are strong relationships between climate, a species and its environment. Climate variables such as temperature, rainfall, and other climate variables influence :

- where and when species are found
- how species behave (including pollinators and pest species)
- the timing of natural events, such as migration, breeding and moult
- the availability of food sources, such as seeds, flowers, insects & other prey items

The Intergovernmental Panel on Climate Change fourth Assessment Report (2007, IPCC 4AR) showed that most information from Northern Hemisphere (esp. Europe) (99.6%) are available while very little information is available in the southern regions. There is very poor coverage in the tropics and thus there is not much information available to better understand climate change and its impacts. The IPCC 4AR discussed that some responses from biodiversity due to the warming temperatures can be summarized by;

1. Change in distribution
    - Southward shifts
    - Altitudinal shifts
    - Range contractions
    - Abundances changes as ecological habitat changes
2. Change in abundance / population status
    - Direct mortality – extreme events
    - Change in breeding success
    - Change in competition / predator – prey relationships
    - Pathogen, parasites, etc
    - Extinction risk
3. Change in life-cycle events
    - Migration
    - Breeding
    - Flowering / seeding etc

- Growth rates
- Sex ratios
- Dispersal
- Fecundity / reproduction

4. Genetic / Evolutionary change
5. Physiological change

- Body size
- Plant toxin levels and leaf protein and chemical concentration

Sudden changes in the environment may be related to sudden changes in climate, for example:

- Threshold / non-linear changes (e.g. migration timing Orange-bellied Parrot)
- Earlier departure of certain species when warmer (> 10.5 ºC)
- Prolonged periods of hot dry conditions increase risk of fire, including power-pole fires
- Synchronized breeding in seabirds increase vulnerability, esp. burrow nesting species
- Little Penguin maladapted fire response

7.2 Local Knowledge

"We can tell what season it is by looking at what the plants and animals are doing"

Local knowledge about seasonal indicators and weather is not new. Local knowledge plays a key role in climate and weather early warning systems, particularly in very remote areas where access to information and communication is limited. Local knowledge on climate is often imbedded deep in Vanuatu's various cultures, but the wealth of this knowledge has not yet been tapped. As such, an entry point for discussing climate change, variability and extremes with these communities is to understand and document this vast knowledge. Local knowledge may be the avenue by which the VMGD may engage communities in the recording and forecasting weather & climate. Because local knowledge tends to be rooted in experience, and related to past weather and climate events, it may also be reliable source of information about future change. One way that local knowledge is able to feed into predictions is through the identification and study of 'local indicators' or plants and animals that act as climate signalers. Biodiversity climate indicators have been used for thousands of years by cultures around the world, and include

- **India:** blooming of golden shower tree and direction of local winds predicts onset of monsoon

- **New Zealand:** early flowering of Pohutuawa, expect long summer and drought
- **Tanzania:** early and significant flowering of Mihemi and Mikwe signal of good rainfall season
- **Tonga:** Bees nesting near ground sign of active cyclone season to come (Living Black)
- **Australia:** White-breasted Woodswallows found with Magpie-larks signal the beginnings of the wet and dry seasons (Living Black)

While it is generally accepted that Traditional Knowledge can contribute to climate resilience building of communities, there are strong indications (globally) that this knowledge is being lost in relation to increased modernization, cultural homogenization and lack of transmission of information. Climate change is also changing the way indicators are used and their effectiveness. Changes in climate can often create a mis-match in a certain indicator and its expected outcome, for example;

- "the trees are flowering much earlier now and they don't tell us what they used to. This might be a result of climate change" Maori, G. Kemara (NZ)
- "We relied a lot upon reading the sky and reading other signs. I can still tell the weather using the old ways but with far less reliability" Maori, Elkington (NZ)
- "People on Pileni (Solomon Islands) can no longer use traditional signals to predict the weather with the accuracy they once did … trust in traditional methods is being lost"

Similarly in Vanuatu, the modern use of climate indicators is met with both expressions of confidence as well as disappointment and distrust. The excitement is generated when a community's own cultural/traditional indicators are currently functioning and validated by meteorological science, and residents see the potential for the use of these indicators. There is an equal measure of disappointment however, when communities realize that many of the indicators used in the past are no longer accurate in today's climate change context, or that they have taken indicator knowledge for granted and are not familiar with them.

There is now a growing recognition that local knowledge can complement modern seasonal forecasting information. For example, in Kenya's Meteorological Department (KMD) they have worked to blend traditional forecasts with science-based predictions to produce more accurate – and more well-received weather and climate data at the local level. Combining natural observation with modern science can build up climate change intelligence and help to make the data available to subsistence farming communities. Traditional knowledge is useful in turning broad science-based predictions into local forecasts, helping locals to adapt to shifting climate patterns.

7.3 Vanuatu's Traditional Climate Indicators

Traditional indicators are especially important in Vanuatu and have been part the culture for many years. Traditional indicators exist at different levels, for short term and long term forecasting. These indicators are also intertwined with activities and other calendars of activities such as cropping calendars. There may be a need to identify and separate each of these activities according to sector-specific interest. Improving the level the detail of and validating many of the indicators has yet to be undertaken.

As an example, some local cropping and climate indicators from the island of Tanna are shown below.

- Banana grown during full moon is said to have a higher yield or production
- Wild cane flowering is an indicator of yam being ready for harvest
- When the stars (locally called *nawaswas lapnuman*)are lined in a 180°C from the north also means that yams are ready for harvest
- When wind changes its direction during the cyclone season and blows from the (northerly direction) it indicates the cyclone season.
- When cattles (cows) are seen excited (shake head, legs or even jump, it means that there will be rain in the next few days.
- Taim ol fisherman oli stat blo kasem flying fish I min se solwota I wam mo tu I save indicatem se bai saeklon I kilinm yumi (stat bildim nima latan).
- Yellow honet (Sof mad) taim istap bildim nest blo hem insaed I min se hemi stap pripea from saeklon or wan long fala period blo rain

Local observations on Changes to Weather

- Rain and sun can occur in any month of the year.
- There are periods of excessive rain or excessive sun for long periods of the year.

Local Observations on Changes in the Cropping Calendar

- Before the planting time for yams (the main traditional crops) was July-August, now it has shifted to May-June.
- Fruits such as coconuts and mangoes have started flowering and producing fruits inland (Middle Bush) whereas before they only produced fruits in the coastal areas.

- Before yams were planted in all areas of Tanna, but now yams are not planted inland (Middle Bush) because there is not much rain and there are problems with Anthracnose.

Local Observations on Changes to Weeds and insects

- African snails and millipedes have started appearing on Tanna, they were not there in the past.
- Before hornets were found in the coastal areas only, but now they appear inland (Middle Bush)
- Before weeds such as wild peanut, *Meremiabeltata* and glycine didn't appear on Tanna but now they are growing inland

7.4 Best approach for Collecting (Local) Traditional Knowledge and Calendars

During discussions at the summit, it was widely agreed that a large scale and systematic collection of traditional knowledge related to climate change, climate, weather and seasonal indicators must be undertaken. While critically important, there are a number of outstanding questions regarding this exercise. Principally these include:

- Rights associated with knowledge and sharing of this knowledge
- Frameworks for collection, storage and stewardship
- Resources for documentation
- Collaboration among partners (nationally and internationally) who are interested in this knowledge.

Of critical importance are the Legal Issues associated with Traditional Knowledge:

International agreements and conventions on traditional knowledge (TK)

- International Undertaking (1983),
- Convention for Biological Diversity (1992)
- International Union for the Protection of Plant Varieties (1961)
- World Intellectual Property Organisation; Intergovernmental Committee on Intellectual Property and Genetic Resources,

The first step in this process is the development of a national policy and legislation on traditional knowledge and expressions of culture (TK-EC). The policy should cover three main areas:

1. Collection
2. Management
3. Sharing

	What	How	Who	When

A. Collection	• **Local Indicators for forecasting**
	  • **Short**
	  • **long**
	• Traditional Calendars
	• Mitigation & Adaptation Methods
	  • NDMO
	  • Existing Projects
	• *Traditional Knowledge (Traditional Man)*
		<u>Launched through a Project</u>
		• Fast results
		• Built the profile of the collection and use of indicators
		<u>Workshop</u> to Launch/Compile:
		Development of procedures, templates, etc to ensure consistency
		<u>Tools</u>
		• Face to Face interview
		• Survey Forms
		• Voice records
		• Video camera
		• Nakamal Group Technical
		• Participatory Approach
		• Training & documentation
			• Productive Sectors
			• NGOs (eg. RC, WSB Vanua Tai Resource Monitors)
			• VKS Field Workers
			Use of existing networks to have a far-reaching impact
				As soon as Possible
				(2012-2013)

B. Management		• Create Database • **Documentation** • Archiving	• VKS • VMGD (New Act)	
C. Sharing		<u>Guidance when Sharing</u>:	Public	As soon

		Permission/Acknowledge Source • Video Documentary • Publish in Website • Exhibition • Booklets to Complement modern forecasting	Domain	as data is validated

8.0 Communicating Climate Change

8.1 Information to the Last Mile

Key Challenges

- Technical information if not simplified may be very difficult for farmers to understand
- Many of the communication mechanisms to outer islands and rural areas are incomplete and patchy. For example, radio reception and mobile telephone networks in some islands are a problem.
- Sectors and officers are often operating in isolation, duplicating work at best, and providing contradictory messages at worst.

Vanuatu's geography and isolation provides unique challenges in the distribution of information from technical climate and agriculture officers to the wider community. To improve communication among the VMGD, Department of Agriculture and farmers, a multi pronged approach was prioritized, using multiple communication methods to best equip farmers with technical information on forecasting and how to best respond to predictions.

The government's National Advisory Board on Climate Change and Disaster Risk Reduction (NAB) (formerly known as the National Advisory Committee on Climate Change (NACCC)) plays a key role in the communication of projects associated with Climate Change to high level government, as well as mainstreaming Climate Change into all government sectors.

Multiple government and non-government agencies are involved in information dissemination about climate change with communities and farmers. While most have historically focused on disaster risk reduction, many now wish to engage in climate change preparedness activities. Working across government sectors and NGO's will allow information to be further dispersed through increase networks and education/ awareness activities.

NDMO is working to establish the cluster system that looks at all government and non government agencies working in the areas of disaster preparation, response and recovery. Cluster groupings will also focus on ENSO as a part of their mandate. All five clusters (Logistics, Education, WASH, Health & Nutrition and Agriculture & Food Security) will have the responsibility at looking at ENSO and ways to best prepare, respond and recover to create community resilience.

Through the Climate Change section of VMGD, agriculture officers have access to seasonal forecasts. The current means of delivering climate change information directly to users is through VMGD website, Facebook page, monthly bulletins, media releases, stakeholder forums and impact

assessments. Work is being done to collect and synthesize information on the impacts of Climate Change from the field and reporting on these impacts. This will increase the awareness of impacts and better allow the development of information and materials to inform communities of solutions. This can then be the start of building a manual for adaptation to climate change, variability and extremes.

The link among the work of VMGD, GIZ, NDMO, NGO's Civil Society is the department of Agriculture. The Department of Agriculture staffs are placed throughout Vanuatu and have direct links with farmers. The current structure of DARD on a community level has 30 field officers, as well as 10 technical officers, 6 provincial officers a Provincial Extension Officer and Director. DARD's mission is to build a robust Agricultural Sector that significantly increases Food security and Trade of local agricultural products on the domestic and export markets.

The links between farmers are developed and strengthened through field days, interactive farming techniques, demonstrations and farm visits training activities. Working on farm visits or field days illustrates best practice and new technologies, while also understanding traditional practice and custom. The DARD has developed a system of lead farmers for the development of nurseries and training and has used agriculture cooperatives and farmers associations to develop their work with farmers. DARD also uses in communication with farmers is printed education materials and radio broadcasts. Duty statements of DARD staff must be revised to reflect the integration of climate change into the department's services.

While education and awareness is important, there is increasing pressure on Agriculture research officers to find, test and improve climate adaptation solutions. Currently agricultural research results are not produced or published fast enough in Vanuatu to address the emerging issue of Climate Change. There is a need to improve the capacity to undertake basic on-farm trials of crop selection among the staff of DARD and other extension agencies.

8.2 Strategies for information dissemination

Vanuatu's strong community networks and structures provide a good base to rapidly disseminate climate change related information to multiple communities. The use of networks like the churches, chiefly structures, provincial governments, area councils, men's and women's groups is essential in the flow of information from government to the community and vice versa. As part of a multipronged approach, multiple strategies should be taken simultaneously

Strategy 1: Government Structures

Vanuatu's National Government is primarily based in Port Vila, with Provincial Governments set up and headquartered in all 6 provinces. Government departmental headquarters (e.g. Agriculture, Meteorology) are all based Port Vila but many have extension officers stationed throughout the islands. VMGD for example has meteorological stations and officers throughout Vanuatu providing information to and from the headquarters in Vila.

The Provincial Government has a network of Area Secretaries on every island and more than one on the bigger islands. One role of the Area Secretary is to link provincial government and communities. The Area Secretary has a wealth of knowledge about their local community and provides feedback to the Provincial Government regularly.

Strategy 2: NGO's, Civil Society and Volunteer Programs

Vanuatu has many international and national NGO's who are working throughout the country. Often these NGO's are working in some of the more isolated islands of Tafea and Torba provinces, where the communication links and government services are the weakest. They have networks of trained staff and volunteers working in a variety of projects from Health to Education to Disaster Management and Climate Change.

A successful example of an NGO network is the Wan Smol Bag Vanua'Tai Resource Monitor's network, which works with all segments of society from youth to elders to consider environmental management issues. The Wan Smolbag national programme works with young people in the development of drama, radio programs, illustrations to look at topics relevant to the community and present them in an entertaining and informative forum to the community. They regularly use the over village members of the Vanua'Tai network to disseminate pertinent information. The success of Wan Smol Bag is known throughout the Vanuatu with plays performed throughout the country and comic books distributed widely.

As the NGO's and CSO provide a valuable network within the community so does the volunteer network. Volunteer Services Overseas, Volunteer Services Abroad, Peace Corps, JICA and Australian Volunteers for International Development have skilled volunteers throughout Vanuatu. Hundreds of volunteers are situated within Vanuatu at any one time.

Strategy 3: Community Structures

Vanuatu villages often have strong community structures that assist in the dissemination of information. Strong chiefly structures, 95% of the population assigning themselves to faith based organization, strong community leaders and community groups (i.e Vanwoods committees) and 'My Time' traditions of kava drinking and telling stories at the meeting place of a Nakamal.

This strategy focuses on not recreating a community structure to assist the dissemination of information but to have governments and NGO's use the existing structures better. The use of these structures needs to enable both the downward and upward flow of information.

Providing information and training to community leaders, churches, community groups and having discussions at Nakamals can provide great opportunity for information to flow to the wider community.

Strategy 4: Mass Media and Telecommunications

Currently both the VMGD and NDMO use mass media and telecommunications to warn the communities of potential hazardous weather, tectonic and volcanic movements. Throughout the group discussions it was suggested a multi media/ telecommunication approach to upcoming ENSO events be expanded. It was noted that no one media or telecommunication that reaches all islands and areas of Vanuatu.

The use of text messaging, prerecorded and live radio programs and newspaper articles are effective at bringing information to communities. Agreements must be reached with telecommunication companies (Digicel and TVL) on the dissemination of information, including what is included in texts and how they would be most efficiently sent. Discussion should also happen with media outlets to create dissemination options in the lead up to and during ENSO events. Educational information on ENSO should include best practice in preparation and recovery relating to food security.

A multi-strategy approach

To improve communication networks throughout Vanuatu, all strategies need to operate simultaneously and collaboratively. As previously mentioned, the isolation and logistical constraints within Vanuatu make it difficult to rely on only one source of information. However, the approach of building on existing networks, rather than re creating them, has been highlighted.

As an example of a coordinated and dualistic approach to communication: Wan Smol Bag creates a radio play about traditional planting calendars and how they may have changed over the years, while simultaneously providing new volunteers with information on impacts of Climate Change relevant to the islands where they will be stationed. Government should regularly be working alongside NGO's to not only in the area of Community Disaster Committee training but also how these committees can record and report on climate change events. There are many ways to get information down to the community but we must use multiple approaches to retrieve information as well.

Some key priorities that emerged from this summit were the collective focus on 1.impact databases to map CC hotspots throughout the country and 2. DVDs and documentaries which are most engaging and potentially reach the largest audience.

8.3 The NDMO Cluster System & ENSO Early Warning

8.3.1 Integrated Agriculture ENSO Cluster

The NDMO uses a Cluster System to monitor and asses the impacts of hazards and severe events. These clusters were developed in 2012 and trialed after Tropical Cyclone Jasmine in February 2012. There already exist 3 Clusters including Education (Consist of Department of Education, UNICEF and STC, Logistics (NDMO), and WASH (Water, Sanitation and Hygiene) (RWS + UNICEF). Two clusters have yet to be fully established including: Agriculture/Food Security /ENSO and Health/Nutrition.

Cluster groups are responsible for coordination of preparedness, response and post event recovery. This includes disseminating information to respective sectors and general public, ensuring plans are in place on how to minimize or adapt impacts, monitoring and gathering reports of impacts in each respective sectors, work with all clusters for response or recovery after disasters or events. Cluster groups generally include members of sectors that are most affected by disaster events and those that can provide further information and/or support on such events.

A similar cluster approach should be used before, during and after an ENSO event. But is an ENSO event a disaster? A disaster may be defined as a situation when communities and government find it difficult to cope with the impacts of a hazard and require external support. While impacts from ENSO events may often be regarded as disasters, these impacts are often more long term than immediate. Thus the national government's allocation of resources for such events is very minimal compared to that of tropical cyclones and other natural disasters that have immediate impacts on the communities.

A suggested way forward to merge the Agriculture Cluster with an ENSO committee. Possible Membership in the ENSO committee/Agriculture Cluster include the National Disaster Management Office (NDMO), Agriculture Department, Media, Forestry Department, VMF/Fire Service, Cultural Center, Hydrology/Rural Water Supply, Fisheries Department, Health Department, Chamber of Commerce, and Reserve Bank. During ENSO events, the Cluster/ENSO Committee Functions will be to work with all stakeholders for preparedness, response or recovery for an ENSO disasters or events in areas most affected.

8.3.2 ENSO Early Warning System

Once an ENSO committee has been established, formal ENSO procedures will be implemented that define the provision of timely scientific information to communities via existing government and NGO networks. The development of an ENSO Early Warning System may be seen as a way of effectively informing stakeholders and communities prior to and during an ENSO event (El Niño and La Niña).

Any ENSO Early Warning System shall have the following components:

A. Enso Desk and Diary
   - Manager (climate services) activate ENSO desk
   - Manager and PSO handling the ENSO desk
   - The desk handles all queries regarding the event
   - Any reports from media sources regarding the event shall be recorded in the diary

B. Media Release
   - Director to convene a ENSO committee meeting
     - *Activate alert procedures if more than 50% chance of ENSO events*
     - *The information disseminate by media*
   - Product distribution
     - *Vanuatu climate update to all ENSO alert group & Govt email system*
     - *Webpage*
     - *Intranet*
     - *Mail*
     - *Forum with Stakeholders*

C. Final Bulletin
   - At the end of the event the Manager shall prepare information to be issue by the director to the committee, clients, and general public.
   - The director shall then deactivate the alert Desk status at the Climate Section.

D. Assessment & Report
   - A report will be compiled after each ENSO event
   - The ENSO committee shall contribute to the report
   - The timing (longer timeframe) of events makes it hard for authority to take it as a priority (disaster)
   - Currently VMGD carries out random telephone survey throughout the country
   - The report should be made public and also to schools then help students better understand ENSO

E. Existing Gaps

- Alert procedures in different sectors
    - *VMGD to develop alert procedures according to different impacts*
    - *Each sector should have own ENSO alert procedures*
    - *Tailored specific products for each sector (initiative from each sector)*
        - E.g. Agro-met bulletin for susceptible crops
    - *Emphasis on the importance of using the ENSO warning similar to Tropical cyclone and tsunami warnings*
        - Impacts over a longer timeframe and not immediate
    - *The Government through VMGD and NDMO should have a budget to carry out assessment after an event (La Nina and El Nino)*

8.4 Memorandum of Agreement (MoA)among DARD, VMGD & SPC-GIZ

The Vanuatu Meteorological & Geohazards Department, Department of Agriculture & Rural Development, and SPC-GIZ have signed an agreement to work together to improve the delivery of climate services and information to the farming communities most in need. This innovative networking partnership will see climate and climate change information (including seasonal forecasts) transferred from VMDG to DARD via various delivery mechanisms including bulletins, seminars/workshops, radio and newspaper.

The importance of this for farmers will allow them the adjust crop selection in the short term depending on rainfall outlook and long term look at different crops to adapt to the changing climate. Getting seasonal forecasts to farmers in a manner that provides them option and time to respond will improve food security and community resilience.

Climate change is often linked to extreme weather conditions and variability within the climate. The importance of this is linked to the ability of farmers to adapt to extreme events which they have been doing throughout their existence, developing clear and effective strategies to protect themselves, their family and their existence. A community's ability to adapt to Climate extreme will leave them well prepared for the long term effects of Climate Change.

VMGD will produce climate technical information and forecasts, SPC-GIZ will support its translation to appropriate agricultural contexts, and DARD will disseminate it and provide comments and questions. Simplification of the information is critically important as climate information is often technical, and includes complex concepts like probability and uncertainty. Agriculture adaptations strategies and suggestions can then be developed by DARD and SPC-GIZ in line with this information.

The translated climate change information and seasonal forecasts, together with suggested adaptation strategists, are delivered to the Agriculture extension network especially the Agriculture field assistant (AAOs) which has for decades maintained a close relationship with the farmers. With this information, farmers will be better informed of the probable ensuing climate and have the know-how to adapt, including but not limited to introduction of any climate resilient crops.

Communication is not the only aspect of the MoA, as it will also broadly ensure complementarities among the VMGD, SPC-GIZ and DARD. Through this agreement, the staff of DARD will learn new ideas on climate change issues and seasonal forecast and this will ensure that precise and quality climate information is delivered to the farming community. Furthermore, collaboration will be strengthened in carrying out research trials and establishing rain gauges to collect rainfall data.

This MOA will also enable VMG, DARD and SPC-GIZ to continue existing research work on the farming system trials, canopy architecture and intercropping to determine if there are advantages in terms of climate change.

8.5. Harmonizing Assessment Tools for Collecting Impacts to Climate Change

At present in Vanuatu there are multiple actors supporting communities to adapt to climate change. As a prerequisite to this support, most undertake some form of climate vulnerability or baseline assessment. While collecting information is unquestionably important, each stakeholder is currently collecting different information, using different methodologies and formats.

The government of Vanuatu aspires to develop climate assessment standards, applicable to all stakeholders. A set of assessment standards will enable each agency to utilize its own methods and approaches, but allow the results to be fed into a single system for assessing all vulnerabilities in the country. Collective and uniform reporting on national activities is a key commitment of the country under its UNFCCC obligations. Assessment standards will also support the newly established National Advisory Board to coordinate and monitor the assessment efforts both government and non government agencies.

As a first step, a critical analysis is required that would involve collating and evaluating of all currently used community assessment tools and looking at how they differ in their objectives and methodologies. This will be a long term process of working with all partners to create a suite of assessment standards, including add-ons specifically addressing climate change, disaster risk reduction, child led adaptation, gender empowerment and food security.

The government already has a process in place for carrying out climate change community vulnerability and Adaptation (CV&A) assessments based on community priorities. This methodology has been published widely and recognized under the UNFCCC processes. This tool was developed with SPREP and already used to implement adaptation projects in Vanuatu. The tool is however only limited to climate change and does not consider clearly other areas such as non-climate risks etc.

Care Vanuatu currently uses a 'community profile' process that includes a Community Profile, Community Hazard Record, Risk Perception, Hazard Mapping, Impacts of Climate Change, Community Preparedness and Existing Practices. Red Cross Vanuatu uses a Vulnerability and capacity assessment (VCA) which is an investigation that uses participatory tools to understand exposure and capacity to (natural) hazards at the grass-roots level. The VCA is a process that allows people to identify and prioritise Risk in order to designing actions for disaster risk reduction.

The NDMO has also recently developed an Assessment Forms for Collecting post disaster impact information. The form was developed in January 2012 and trialled following TC Jasmine. Its applicability was reviewed as a part of lessons learnt from TC Jasmine March

2012. The Rapid Assessment works through the coordination of the NDMO Cluster groups, and key government technical officers in the areas of Agriculture, WASH (Wash/ Sanitation/ Hygiene), Child protection, Logistics and Health. A key objective of the form is to verify reports of damage from the community, and for technical officers to assess areas affected and compile recommendations for the NDMO to share with NDC, VHT and Donors. The subjects considered include: General Information, Infrastructure, Population information, Water supply, Hygiene /sanitation, Damage to food supply, Health, Education, Shelter, Security and protection, Communication, and food items supplies.

At present, ENSO-related questions are not yet included in the NDMO Assessment Form. In relation to ENSO, damage to food and crops occurs quickly and so requires rapid assessment. Any Agriculture rapid assessment form procedures should both interview farmers and also visit gardens. To appropriately gauge impacts assessment should be made before, during and after ENSO event. Assessment of event impacts must involve specialized sectors and officers, e.g. forestry.

A recommended step is to invite all stakeholders to review existing assessment tools and agree on a more standardized and coordinated approach to assessing, reporting on, and storing information about community vulnerabilities to climate and non climate hazards.

8.6 Climate and Oceans Support Program for the Pacific (COSPPac)

COSPPac is an Ausaid funded project implemented through the Australian Bureau of Meteorology over the next few years. The project hopes to work with Vanuatu partners to document important local knowledge for seasonal forecasting and verify whether or not climate change is impacting on its accuracy. In this case, historical records can play an important role where they exist. The project will also try to compare seasonal forecasts made through the use of local knowledge with those based on science-based methods and finally highlighting strengths of both systems and how they complement each other.

8.7 Coping with Climate Change in the Pacific Islands Region Programme (SPC-GIZ)

SPC-GIZ's CCCPIR Programme has been working in Vanuatu since 2009 to enable partners (national, provincial and community) to adapt to climate change. It works strongly with the land-based sectors of agriculture, forestry and livestock in order to support CC mainstreaming in policies and strategies. CCCPIR Vanuatu has also developed programmes for assessing the impacts of climate change on specific sectors, as well as leading the documentation of realistic adaptation strategies. Most importantly the SPC-GIZ programme is working alongside government sector departments to trial various adaptation technologies n communities, with a view to scaling up on a national scale.

9.0 Recommendations and Way Forward

Overall this summit was deemed a major advance for the land based sectors on climate change. A next summit is planned to take place on Tanna Island in early 2013, with over 80 government extension officers in attendance from throughout the islands.

While the summit was judged an overwhelming success by all participants and observers, there were a few key recommendations for the next summit.

- After hours debriefing (did not happen) , and this should be included for the facilitators in the next summit
- Having meals together and in one location is critical to keep participants at the venue.
- Unbudgeted activities occurred and were critical for the smooth running of the summit, in next year's budget some resources should be allocated to cover these unexpected costs.
- Fixed per diem rates for all is important. This year each group of participants (govt/NGO/community etc) was on a different per diem rate, and this was felt to be unfair by all.
- Private bank accounts should be used for financing where possible vs. use of govt system to fast track and avoid complication (e.g. this year money was funneled through the GIZ accounts and was effective)
- Directors to inform their staff of any changes in per diem if in the future organizers are unable to pay full government rates
- Departments must contribute more to future summits, by proving some costs towards the logistics and staffing.
- More consideration should be given to how large quantities of workshop cash can be handled in a transparent and safe manner.
    - Advance preparation of per diems
    - More secretariat and finance support staff on hand

APPENDICES

Appendix: Summit Agenda

PROGRAM

National Workshop to improve understanding on Climate, Climate Change and their impacts on Agriculture

12-16 March 2012, Vanuatu Agriculture College, Santo

Sunday 11 March, 2012

	Participants arrive
18.00	Ice breaker

Day 1 – Monday 12 March 2012 (Opening, Meteorology, Climate and Climate Change)

07.30	***Welcome and Opening***	***Chair:*** *Brian Phillips, NACCC Secretariat*	
07.30	Registration	All Participants	
08.00	Prayer	Father (Anglican Church)	
08.10	Welcome Remarks	Peter Napwatt, Chief Executive Officer, Vanuatu Agriculture College (VAC)	
08.15	Opening comments	Jotham Napat, Chairman, National Advisory Committee on Climate Change (NACCC)	
08.20	Keynote address	*Trevor Moliva, Lord Mayor, Luganville Municipality*	
08.40	Introduction to workshop	Dr. Chris Bartlett, SPC-GIZ Salesa Kaniaha, VMGD	
09.00	**Morning tea** **GROUP PHOTO**		
09.30	***Introduction, Climate Science and Services***	***Chair:*** *Jotham Napat, VMGD Director* ***Scribe:*** *Melinda, Mike, Chris*	
09.30	Introduction of Participants	All	
09.40	Climate/Change Science and Impacts	Salesa Kaniaha (VMGD)	1

10.00	ENSO Events	Silas Tigona (VMGD)	1
10:40	Services and Products of the VMGD and Warning Procedures	Philip Malsale (VMGD)	1
11.00	**Panel Discussion 1:** Group Discussions on the ENSO Warning Procedures and endorsement	All	1
12.00	**Lunch**		
13.00	***Strengthening Farmers with Climate Change Information***	*Chair: Jotham Napat, VMGD Director* *Scribe: Melinda, Mike, GiZ Interns,*	
13.00	Climate change and Local Knowledge	Lynda Chambers (BoM) and Chris Bartlett (GiZ)	2
13.20	Linkages between DARD and Rural Communities in a changing Climate	Ruben Bakeo (DARD)	2
14.30	**Activity 1:** Group Discussions on how we can strengthen climate change information to and from farmers and presentation	ALL	2
15.00	***Afternoon tea***	*Chair: Jotham Napat, VMGD Director* *Scribe: Climate Staff, GiZ Interns*	
15.30	Best approach for Collecting and documenting Local Knowledge related to Climate Change science, extreme, adaptation and mitigation in Vanuatu	Marcellino Ambong (VKS)	3
16.00	**Panel Discussion 2:** Promoting Traditional Knowledge for Climate Change Adaptation	Marcellino Ambong (VKS) & Christopher Bartlett (GIZ)	3
17:00	**Day 1 Close**		
19:00	DOCUMENTARY MOVIE: An Inconvenient Truth	Optional	

Day 2 – Tuesday, 13 March 2011 (Agriculture and Climate Change/Extreme)

07.30	***Climate Change and Agriculture***	*Chair: Ruben Bakeo, Director, DARD* *Scribe: Climate Staff, GiZ Interns*	
07.30	Recap of Day 1		
07.35	DRR and Custers	NARI	4,5,6
08:00	Impacts of climate change/extreme on crops and planting calendars in Vanuatu	Roger Malaba, VARTC	4
08.30	Strengthening Appropriate Agriculture information to support farmers adapt to climate change/extreme	Christopher Bartlett (GiZ) Mike/Melinda (VMGD)	4
09.00	**Panel Discussion 3** - Impacts of climate change/extreme in Agriculture and consolidating an information package to support farmers adapt	ALL	4,5
10.00	**Morning tea**		
10.15	Importance of Traditional Crop Calendars changing climate indicators on Tanna	Willie Iau, PAO Tafea, DARD	5
10.30	**Activity 2:** Group Discussion (on approaches) to redevelop a cropping calendar for Vanuatu Presentation	All	4,5
12.30	**Lunch**		
13.30	***Field Trip***		
13.30	**Field Trip 1**: to VARTC to view ongoing research into resilient trials and learn key adaptation strategies	Marie Melteras, Roger Malaba and Ruben Bakeo	6
18.00	Day 2 Close		
19:00	DOCUMENTARY: Climate Change and Agriculture in Vanuatu	Optional	

Day 3 – Wednesday, 14 March 2012 Live Stock and Climate Change/Extreme Events

08.00	***Livestock and Climate Change***	*Chair: Benuel Tari, Director, DLQ* *Scribe:*	*OP*
08.00	Recap of Day 2		
08.30	Climate Change/extremes and livestock	GIZ, SPC	7
09.00	Launching of SPC Fact Sheets on CC and Livestock	SPC	7
09.15	**Activity 3:** Group Discussion on Validation of the SPC Fact Sheet Presentations	ALL	7
10.00	**Morning tea**		
10.30	Livestock and Drought: Experience from Santo	Peter Coleman, Santo	3,4,7
11.00	**Activity 4:** Group Discussion on Strengthening appropriate climate change/extreme information to assist the livestock industry Presentations	All	*7*
12.00	**Lunch**		
13.00	**Agriculture Coping with Climate Change/Extreme**	*Chair: Selwyn James Wasi* *Scribe:*	
13.00	**Activity 5**: Discussion on elements of a proposal to establish of Provincial Nurseries & CC Demonstrations with extension officers, NGOs and communities	All	6
14.00	Group work & Presentations	All	6
15.00	**Afternoon Tea**		
15:30	Vulnerability Assessments for Climate Change/Extreme/Variability: What questions to ask, what to look for when assessing vulnerability	Christopher Bartlett, Florence Le Paulmier	2
16.00	**Activity 6:** Group work & Presentations	All	2
17.30	**Close of Day 3**		

Day 4 – Thursday, 15 March 2012 (Forestry and Climate Change)

08.30	Coastal Rehabilitation through Forestry	*Chair: Forestry Director* *Scribe:*	*OP*
08.30	Recap of Day 3		
08.30	Introduction to Sea Level Rise, Geomorphology & Climate Change	Dr Christopher Bartlett, SPC-GIZ	8
09.00	Introduction to Coastal Rehabilitation through Forestry, Regional Experiences	Cenon Padolina, SPC	8
09.30	Coastal Rehabilitation through Forestry, Vanuatu Experiences	Ioan Viji (Forestry), Rolenas Baereleo (DEPC), & Pablo (Red Cross)	8
10.15	**Morning tea**		
10.30	**Activity 7:** Group Discussions on Guidelines and best-practice for coastal rehabilitation in Vanuatu	All	8
11.30	Q & A Discussions/Presentations on coastal Rehabilitation Guidelines	All	8
12.00	**Lunch**		
13.00	***Excursion for Coastal Rehabilitation***		
13.00	**Field Trip 2:** Excursion to visit potential coast rehabilitation sites and to validate guidelines	All	8
18.30	Workshop Dinner Signing of an MoA between VMGD and DARD	Hosted by GTZ, DoA, DoF, DoLQ, VMGD Invited Guests	

Day 5 – Friday 16 March 2012 (Wrap up)

08.30	**Wrapping up**	*Chair: Christopher Bartlett* *Scribe:*	*OP*
08.30	Introduction to Climate Video Diary Exercise		
8:45	Working Groups on Video Diaries		
10.00	**Morning tea**		
10.30	Working Groups on Video Diaries		
11.00	**Closing of Workshop**		
	Presentation of workshop outcome	Dr. Chris and Salesa	
	Closing Remarks	NACCC Chairman	

	Closing Remarks		
	Finals Remarks and Official Closing	Lord Mayor, Luganville Municipality, Santo	
	Closing Prayer		
12.00	**Workshop Closed**		
12.00	**Lunch & Participants Depart**		

Appendix Summit Participant List

NAME	INSTITUTION	CONTACT/EMAIL/TELEPHONE
1. Jotham Napat	VMGD	jnapat@meteo.gov.vu
2. Barton Bisiwei	Torba Agriculture Officer	5360012
3. Tate Hanington	Forestry	Hanington_tate@gmail.com
4. Pete Turnbull	NDMO	pturnbull@vanuatu.gov.vu
5. Simon Naupa	Forestry	7711665
6. Tevi Obed	W Bank/Meteo	5955084
7. Sam Channel	Forestry	5342927
8. Jude Tabi	Forestry	5396126
9. Greg jenks	Clim Systems	gkjenks@gmail.com
10. Toufau kalsakau	Forestry	7768273/ toufau@gmail.com
11. Peter Iesul	DARD	piesul@vanuatu.gov.vu
12. Robson S T	VMGD	24686
13. Melinda Natapei	VMGD	melnat@meteo.gov.vu
14. Julie B	FSA	jdbvanuatu@gmail.com
15. Donna Kalfatak	DEPC	dkalfatak@vanuatu.gov.vu
16. Lonny Bong	Livestock /Forestry	7710062/ ibong@vanuatu.gov.vu
17. Baigeorge Swua	Livestock /Forestry	5551192 / bswua@vanuatu.gov.vu
18. Sam Naiu	Agriculture	7763689
19. John Willie	Agriculture	5613172
20. Jimmy Pakoa	Agriculture	7748230
21. Sitiveni Tuilautala	GIZ Tonga	5345398
22. Antoine Ravo	DARD	7713837
23. Thomas Putunleta	GIZ	5396563 putunletathomas@gmail.com
24. Isso Nihmei	GIZ	5697418
25. Wycliff B	Environment	5375491
26. John Ronneth	NP/MPA	7796694
27. Tom Lorry	GIZ Forestry Nursery	7118565
28. Willie Kenneth	GIZ Livestock Project	5684229
29. Steven Noel	NDMO	7750119/5401298
30. Joseph Tungon	Forestry	5695058
31. Lynda Chambers	BOM	l.chambers@bom.gov.vu
32. Willie Iau	Agriculture	5949824
33. Nickless Lingtamat	Agriculture	5627492
34. Daniel L	Forestry	48705
35. Augustine Garae	VRC	7747847
36. Paolo Malatu	Red Cross	7762262
37. John Lulu	Red Cross	7725634
38. Fisher Young	Red Cross	7798957
39. Rolyn John	Livestock/Quarantine	7101387
40. Lerianne Michel	Red Cross	
41. Richard Narinam	Agriculture	5614740
42. Donald James	WSB	5419965
43. Charlie Manua	GIZ Forestry Nursery	5630979
44. Benuel Tarilongi	Livestock/Quarantine	7749237
45. Henry Jackson	Red Cross	5611458

46. Rebecca Bill	GIZ	5553187
47. George Worwor	VRC	7117724
48. Rolengas T	DEPC/MESCAL	7776000
49. Dick Tomker	Forestry	5478756
50. Ioan Viji	Forestry	7733656
51. Philip P	Agriculture	5610721
52. Tari Molisale	Agriculture	5354395
53. Italuo B	DARD	7769141
54. Norah Rihai	VAC	7758542
55. Nambo Moses	Livestock	7799553
56. Bani William	PACE- SD	baniarudovo@yahoo.com
57. Steve Boe	VQLS	7745948
58. Esrom Molisa	IWRM Project	emolisa@vanuatu.gov.vu
59. Kathy Kanas	VMGD	7793718
60. Godefry B	VAC	7106365
61. Frank T	VAC	7753173
62. Salesa Kaniaha	VMGD	7793702
63. Peter Napwatt	VAC	5907665
64. Fredson Tama	GIZ	5695453
65. Philip Malsale	VMGD	7793704
66. Mike Waiwai	VMGD	5683850
67. Fr. John Sovan	ACOM- Vanuatu	7768295
68. Patricia Setack	VAC	5400037
69. Jasin Tari	Jubilee Gardens	7706999
70. Christopher Barttlet	GIZ	5552187
71. James Wasi	DARD	595886
72. Rodney Aru	VAC	5499746
73. Joel K	DARD	5661856
74. Presley Doro	Forestry	5544920
75. Sylverio Bule	Quarantine	5624447 bsylverio@vanuatu.gov.vu
76. Yankee W	Farmer	7733468

Appendix: ENSO General and Panel Discussions

DISCUSSION, COMMENTS AND QUESTIONS

PANEL DISCUSSION

How will your sector react to an early warning system?

	We are working on some species which can adapt to these conditions. We are also looking for some other adaptive species. We are looking for some farming systems. Cross breading to find new species..? We are trying to help the farmers be aware of their situation. Farming systems: e.g
Livestock	- New breeds. Cross bread wild pigs with domesticated ones to produce those which thrive in harsh conditions - encourage building shelter for animals - plant trees in paddock for shelter bullock - integrate big trees and legume plants for animals We are working on identifying adaptive species to these events.
Forestry	What adaptation measures we can take to adjust to climate change

- What is the behavior of different species in the coming future?
- How can u advice your offices on how they can take precautions?

Forestry

We have identifies 5 species which are encouraged for the farmers to plant.

- Have you done anything to assess the impacts of CC in your sector

Livestock :

We have yet to do some of these.

Forestry:

No assessments

But flowering of species will be affected.

We have a ice box for storage of seedlings.

Agriculture:

We have to continue and research for crops which will be adaptive in the coming climate conditions.

- There are 3 varieties Taro identified.
- Farming systems encouraged such as Agro-forestry to encourage tree planting with crops.

- Early Warning ENSO

Will it help you and how can you respond?

- How much time in advance can we have a warning for an ENSO event?

2 months in advance depending on the SOI and SST indicators.

Most of the time it's only those in Vila who will get this information so we want this information to be distributed all the way to the field officers.

So we want to work together to collect this information.

SCOPIC gives us the outlook that gives up to 3 month outlooks based on probabilities.

- So far have the sectors been using the info given by the Mets department

Forestry has been using the information given by the mets dpt. Simclim is being used.

We need information about rain.

- There are some challenges presented

Forestry;

There are some challenges presented by CC.

Our Politicians should also be aware of CC so they can allocate money appropriately.

- Are the farmers willing to use info from Mets?

Livestock:

Kasis can be used to feed livestock with CC.

Simclim assist a lot.

Forestry:

There are no problems arising with CC.

We just need more information.

Agriculture:

Sometimes our means is an extra cost for the farmer so when we package our information we don't want to put an extra burden on famers.

- What are we doing about water security in our sectors?

Forestry:

Encourage water catchment areas

e.g Epau

If we grow a lot more trees in may help retain water in the soil.

Livestock:

A lot of farmers don't have water.

We must encourage more planting of plants which have a lot of water.

Also have a lot of paddocks to rotate the cows.

Agriculture:

Too much or too little water will cause problem.

Water will continue to be an issue for us. We

want to ensure that all people have water

Appendix Traditional Crop Calendars in Vanuatu, an example from Tanna

Tredisonal calendar long Tanna hemi base plante long Yam, ol saen blong fruits mo flowers blong ol trees, ol wild lifes long land mo solwota mo ol trade winds. Ol saen ia nao ol man oli stap folem blong predictem ol seasons blong planem ol Agricultural crops. I min se, sipos i gat change long period or manis blong ol samting we i stapanap, hemi save distebem cropping pattern blong Agricultural crops we i save kosem food shortage.

- **January**: I no gat sign blongol pigeon mo animal, heavy rain mo cyclone season. Bread fruit I ripe. North east trade wind hemi blow mo I bringem hurricane.

  Birds and animals hide away. Heavy rain and cyclone season. Bread fruit is ripe. North east trade wind blows and brings hurricanes.
- **February**: Ino gat sign blong wild pigeon moanimol. Hevi rain I fall daonmo cyclone season. Nantau fruit hemi ready. North east trade winds ,rough or calm solwota.

  Birds and animals hide away. Heavy rain and cyclone season. Nantau fruit is ready. North east trade winds ,rough or calm seas.
- **March**: Bush mo weed I grow plenty mo ol green mo brown sea weed I cove remap ol reef. Rain mo Cyclone season I stap yet, Nakavika fruits I ready. North east trade winds, rough or calm sea

  Weeds and bushes grow quickly, and green and brown seaweed covers the reefs. Rain and cyclone season continues. Nakavika fruits are ready. North east trade winds, rough or calm sea
- **April**: Niufala yam hemi ready blong harvestem mo oranges, mandarine, sugarcane mo nakatambol I ready blong harvestem. North east trade winds,rough or calm sea. Last manis blong rain.

  New yams are ready for harvest, as well as oranges, mandarins, sugarcane and nakatamb. North east trade winds, rough or calm sea. Last month of rain.
- **May**: Ol man I ko selectem ol best yam mo best fruits blong overem sacrifces I ko long God. North east trade wind rough or calm sea.

  The best yams and best fruits are selected to be offered as sacrifices to God. North east trade wind rough or calm sea.

- **June**: Bigfala harvest mo selection blong ol yam blong kakae or blong mekem ol custom ceremony. Mango I start blong bearem fruit.West trade wind, rough or calm sea. Dry season hemi start.

  Big harvest and selection of yams for eating and for use in kastom ceremonies. Mangos start to bear fruit. West trade wind, sea can be rough or calm. Dry season starts.

- **July**: Taem blong brushem mo cleanem niu Karen blong yam. Ol tree olsem natavoa, banyan mo blue water I start blong lusim ol lef blong olketa mo dry season I start. Ples I start blong kolkol long night.

  Time to brush and clean yam garden. Trees including natavoa, banyan and blue water start to lose their leaves. Dry season starts.It starts getting cold at night.

- **August**: Ol I start blong ploughem ground, mekem ol mounts mo planem yam. Season blong breeding blong ol pigeon hemi start. North trade wind I mekem ples I kolkol long night.

  Time to start ploughing the ground, making mounds and planting yams. Bird breeding season starts. North trade wind makes it cold at night.

- **September**: Ol yam I start blong grow mo staking I start blong ol rope blong yam I creep long hem. Ol trees we mi bin mentionem antap long maukmai(July) I start blong growem new lif. South west trade wind. End blong dry season

  Yams start to grow and staking starts for the ropes growing from the yam plants. Trees including natavoa, banyan and blue water start to grow new leaves. South west trade wind. End of dry season.

- **October**: Ol yam I grow ful wan mo I coveremap gud ol poles mo beds. ol trees we mi mentionem antap I start blong growem niu leaves. Rain I start blong foldaown smolsmol

  Yams grow quickly and it is time to cover the yam poles and garden beds. Trees including natavoa, banyan and blue water start to grow new leaves. Light rains start.

- **November**: Hemi taem blong kakae hemi short where ol man I depen plenti long Banana mo ol narafala root crops olsem manioc etc.. Nantau mo Nakavika I start flower. Cyclone season hemi start.

Time where there is not much food and everyone relies on banana and root crops such as manioc to support their diet. Nantau and Nakavika start flowering. Cyclone season starts.

- **December**: Hemi taem blong kakae hemi short big wan mo ol man iko long ol olfala Karen blong olketa blong lukaotem ol left ova root crops olsem taro, manioc mo island taro blong kakae. Mango I raep full wan mo Namambe hemi start blong producim flower.

  Food shortages, everyone goes to older gardens to look for left over root crops such as taro, manioc and island taro to eat. Mangoes are ripe. Namambe starts to produce flowers.

Appendix Provincial Traditional Calendars

Sanma Traditional Seasonal Calendar												
Western Name	January	February	March	April	May	June	July	August	September	October	November	December
Traditional Name	Bong Cinaha			Bong Mahariri	Dam Maluni		Bong rara Hulia		Bong Dulea		Bong Langilosu	
Activity in the year	Plenty fruit & colorful trees Cyclone season			Time of hunting Short days Best time to plant sweet potato	Harvesting of new yam		Time of preparing new gardens for yam		Planting of new yam		Plenty of fruit trees Dry period Not enough food Cyclone season	

Penama Traditional Seasonal Calendar (Pentecost, Melsisi)													
Western Name	January	February	March	April	May	June	July	August	September	October	November	December	
Traditional Name	Bolawo	Udumadal	Uduraah	Udumalkes	Wulbara	Lakis	Taurangetget	Taurangmususu	Tetpelak	Ratawak	Raamemee	Raasubu	Boteric
Number of days	31/28	28/28	31/28	30/28	31/28	30/28	31/28	31/28	30/28	31/28	30/28	31/28	29
Activity in the year	Cyclone	Leaves fall off trees, time to plant Taro	Plant taro and dig *tawat* for yams	Small saltwater worms come out	Plant taro - best taro comes from this crop	Narara flowers	Time to plant vegetables	Cut / clear new garden for yams	Plant taro - biggest yield comes from this crop (good quality as well)	Plant yams	Plant taro in the yam garden On 11 Nov big sea worms come out	Latest date to plant yam Plant sweet potatoes	Clean yam garden. Cyclone seasoon
Crops													
Taro	**X**	**XXX**	**XXX**	**X**	**XXX**	**X**	**X**	**X**	**XXX**	**X**	**XXX**	**X**	**X**
Yam			XXX							XXX	XX	X	
Vegetable							XXX						

Banana				XXX							XXX		
Kava	XXX	XXX	XXX	XXX	XXX	XXX	XX	XX	XX	XX	XX	XX	XXX
Kumala												XXX	
Island Cabbage											XXX	XXX	XXX
Livestock													
Fowl							XXX	XXX					
Pigeon							XXX	XXX					
Cattle	X	X	X	X	X	X	X	X	X	X	X	X	X
Flying Fox	X	X											
Events													
Easter					XXX								
Christmas												XXX	
Fishing													
Sea Worm											XXX		
Fishing				XXX						XXX	XXX		
Troka (Big Eye)						XXX	XXX						
Nawita					XXX								
Crabs											XX	XXX	
Weather / Hazard													
Rain (Flood)	XXX	XXX	XXX										
Sun (Drought)							XXX	XXX	XXX	XXX			
Cold						XXX	XXX						
Less Food	XXX	XXX	XXX										

Malampa Traditional Seasonal Calendar												
Western Name	November	December	January	February	March	April	May	June	July	August	September	October
Traditional Name	Wet season					Cool season				Dry season		

Activity in the year	Hot weather, with lots of rain Fruit trees begin flowering, and fruits and nuts ripen Breeding season for animals Beginning of fishing season	Leaves fall Weather is cold South East trade winds Benbow crater (Ambrym volcano) erupts Plant vegetables and root crops Pasture doesn't grow well	Lots of flies Earthquakes come in this season Fishing season continues (Picko fish) Plant yams All nuts are ready
Crops			
Fruit Trees	Flowers and fruit ripen		
Garden		Clean garden	
Yam		Dig yams	Plant yams Time to milk wild yams Time to cut ropes from yam plants
Nuts	Nuts ripen		
Nakavika			Nakavika starts flowering
Namambe			Namambe starts flowering
Naviso		Naviso vegetable starts flowering	
Mango			Mango trees start flowering
Livestock			
Livestock	Breeding season for all animals		
Wood			
Nambangi		Time blong Namangi	
Fishing			
Sea Worm (Palolo worm)			Palolo worms appear in sea
Fishing	Beginning of fishing season		
Crabs	Crabs are 'meatier' with more flesh, fats and flavour		
Weather / Hazard			

Rain (Flood)	Very rainy		
Wind	North-East wind	South East trade winds	
Temperature	Hot	Cold	
Climate Changes noted			
	Continous wet throughout the year	Early start of season and short cooler period with unexpected cold nights.	Shorter dryer season
VMGD support requested:	VMGD should provide forecasts in advance to assist community planning.	VMGD should provide information on short and long term temperature forecasts to assist farmers to plan their work.	VMGD should provide information in advance about relative humidity to assist farmers in planning work.

Shefa Traditional Seasonal Calendar												
Western Name	January	February	March	April	May	June	July	August	September	October	November	December
Traditional Name	Atumorokovusa	Atumorokomatu	Paurango Lolo	Petemasuri	Tarasarasa	Tavakavaka	Viniumariki	Viniumalapa	Madulele	Leausoro	Piliriki	Pililapa

Activity in the year	> New gardens are mixed with yam > It is hot > The seas are very calm > Lots of rain, but also sun	> Yams have become strong > It is very hot > Cyclones happen > The sea is very calm > It is rainy > Fish poisoning on the reef is common, the corals are hot and unhealthy > Seaweed grows all over the reef, soon a wave or storm will come to wash the reef clean	> The trees are flowering > It is rainy, but getting ready to stop > People start to grow vegetable seeds > Cyclones come	> New Yam Festival ceremony > The weather is sunny and begins to be dry	"Tarasasasa"- Noise of dryness, walking through the bush leaves	> Time to brush and burn the new gardens > Yams are ready		> Plant the first yams in the garden (these yams are for the new yam festival only) The place is very cold during the night, and the wind is very strong - Ruatu (SE) winds The whales come to the bay	It is time for sleeping, working is finished Turtles are coming ashore to lay eggs (nesting season)	The hot season is beginning . Leaves of the big burned trees begin to fall. The planting season has finished.		Rest time - not much work to be done
Crops												

Gardens						Time to brush and burn the gardens	Prepare gardens for planting		Make fences around the gardens so that pigs don't start to eat the yams . No planting, people just walk around the gardens	The planting season has finished		
Fruit trees			Trees are flowering									
Yam	Yams are at an early stage, not yet ready	Yams have become strong		Yams are mature, their ropes/vines are dry	Yam leaves are dry and they fall off the plant; When it is dry and windy, hill fires burn so the Sweet Wovile (wild yam) is ready to dig and eat	> The sea is very very dry (you can see the reef come out of the sea) , this means yams are ready > The flower of the Napto falls, that indicates a dry sea, and that yams are ready	Yam gardens are old now	Plant the first yams in the garden (these yams are for the new yam festival only)	Butterflies come out everywhere and many colors, this indicates the yams are growing (and the planted yam is now dead, new shoots growing)	Yams have started producing vines/ropes		
Vegetable			Vegetable seeds are planted									
Namambe			Namambe fruit is ripe									

Breadfruit				The breadfruits begin to ripen								

Shefa Traditional Seasonal Calendar												
Western Name	January	February	March	April	May	June	July	August	September	October	November	December
Traditional Name	Atumorokovusa	Atumorokomatu	Paurango Lolo	Petemasuri	Tarasarasa	Tavakavaka	Viniumariki	Viniumalapa	Madulele	Leausoro	Piliriki	Pililapa
Bananas												The sea goes above the normal high tide, it is time to plant bananas.
Island Cabbage	Other crops are not ready (island cabbage)											
Wood												
Firewood							Time to burn the roots of the big trees that are still in the gardens, the wood is the driest					
Fishing												
Turtles												

Fishing		Fish poisoning on the reef is common, the corals are hot and unhealthy		The mackerel/sardines are many along the shore	The mackerel/sardines are many along the shore							Fish are making eggs (Black piko) and they make schools of fish and travel together : a yellow mangrove makes a flower at this time.
Octopus							During the dry season, when the Nasiko bird cries several times in a row and touches the sea, that indicates that an octopus is on the reef in that place					
Palolo worms										The palolo worms come out of the reefs.		
Weather / Hazard												

Temperature	Hot	Very hot						The place is very cold during the night		The hot season is beginning .		
Rain (Flood)	Lots of rain, but also sun	Rainy	Rainy, but getting ready to stop									
Sun				The weather is sunny and begins to be dry	The soil is very dry			When the full moon comes out, any droughts will be reversed				When the sun goes down and it is red, the next day will be good weather.
Length of days/nights								If the sun rises over Emau island, and travel directly across, the night will be short			Days are long but nights are short.	When the sun rises over Mataso, the night will be long.

Shefa Traditional Seasonal Calendar												
Western Name	January	February	March	April	May	June	July	August	September	October	November	December
Traditional Name	Atumorokovusa	Atumorokomatu	Paurango Lolo	Petemasuri	Tarasarasa	Tavakakvaka	Viniumariki	Viniumalapa	Madulele	Leausoro	Piliriki	Pililapa
Sea conditions		The sea is calm			The sea is very very dry (you can see the reef come out of the sea)						There is brown foam floating on the surface of the sea (called the urine of the stonefish) . The	

											sea is hot and cold in different places. The sea is not very clear (dirty).	
Wind								The wind is very strong; Ruatu (SE) winds				
Cyclones		Cyclones happen	Cyclones come									

Tafea Traditional Seasonal Calendar												
Western Name	January	February	March	April	May	June	July	August	September	October	November	December
Traditional Name												
Activity in the year	Heavy rain and cyclone season. North east trade wind blows and brings hurricanes.	Heavy rain and cyclone season. North east trade winds.	Rain and cyclone season continues. Bushes and weeds grow quickly.	Last month of rain.	The best yams and best fruits are selected to be offered as sacrifices to God.	Dry season starts. Big harvest of yams.	Trees including natavoa, banyan and blue water start to lose their leaves. Dry season starts. It starts getting cold at night.	Time to start ploughing the ground, making mounds and planting yams. Bird breeding season starts. North trade wind makes it cold at night.	Yams start to grow and staking starts for the ropes growing from the yam plants. Trees including natavoa, banyan and blue water start to grow new leaves. End of dry season.	Yams grow quickly, trees grow new leaves. Light rains start.	Time where there is not much food and everyone relies on bananas and root crops such as manioc to support their diet. Cyclone season starts.	Not much food is available.

Crops												
Breadfruit	Breadfruit is ripe											
Yam				New yams are ready for harvest.		Harvest of yams and selection of yams for eating and for use in custom ceremonies.	Time to brush and clean yam garden.	Time to start ploughing the ground, making mounds and planting yams.	Yams start to grow and staking starts for the ropes growing from the yam plants.	Yams grow quickly and it is time to cover the yam poles and garden beds.		
Vegetable											There is not much food, everyone relies on bananas and root crops such as manioc to support their diet	Food shortages, everyone goes to older gardens to look for left over root crops such as taro, manioc and island taro to eat.
Fruits		Nantau fruit is ready	Nakavika (rose apples) fruits are ready.	Oranges, mandarins, sugarcane and nakatamb are ready for harvest.		Mangoes start to bear fruit.					Nantau and nakavika (rose apples) start flowering	Mangoes are ripe. Namam be starts to produce flowers.
Livestock												

Birds	Birds and animals hide away.	Birds and animals hide away.						Bird breeding season starts.				
Livestock	Birds and animals hide away.	Birds and animals hide away.										
Fishing												
Reefs		Green and brown seaweed covers the reefs										
Tafea Traditional Seasonal Calendar												
Western Name	January	February	March	April	May	June	July	August	September	October	November	December
Traditional Name												
Weather / Hazard												
Rain (Flood)	Heavy rain.	Heavy rain.	Heavy rain.	Last month of rain.		Dry season starts.	Dry season starts		End of dry season.	Light rains start.		
Cyclones	Cyclone season.	Cyclone season.	Cyclone season.								Cyclone season starts.	
Cold							It starts getting cold at night	North trade wind makes it cold at night.				
Sea conditions		Can be rough or calm.	Can be rough or calm.	Can be rough or calm.	Can be rough or calm.	Can be rough or calm.						
Winds	North east trade wind blows and brings hurricanes.	North east trade winds	North east trade winds	North east trade winds	North east trade winds	West trade wind.		North trade wind.	South west trade wind.			
Climate Changes Noted												

Weather
• Rain and sun occurs across all months of the year now.
• There are periods of excessive rain or excessive sun for long periods of the year.
Cropping Calendar
• Before the planting time for yams (the main traditional crops) was July-August, now it has shifted to May-June.
• Fruits such as coconuts and mangoes have started flowering and producing fruits inland (Middle Bush) whereas before they only produced fruits in the coastal areas.
• Before yams were planted in all areas of Tanna, but now yams are not planted inland (Middle Bush) because there is not much rain and there are problems with Anthracnose.
Weeds and insects
• African snails and millipedes have started appearing on Tanna, they were not there in the past.
• Before hornets were found in the coastal areas only, but now they appear inland (Middle Bush)
• Before weeds such as wild peanut, Meremiabeltata and glycine didn't appear on Tanna but now they are growing inland.

Appendix Provincial CC & DRR Agriculture Nurseries

During the course of the summit, much discussion revolved around the accessibility to local farmers of climate resilient varieties crops and livestock species. Accordingly each province was asked to define the most appropriate mechanisms to enable this access. Participants were asked to discuss and make proposals around a series of questions including: ***How can we get CC materials to rural farmers? What will be grown for distribution? How will farmers get access to the material? Who will manage/implement the process? What kind of budget is needed? How will this be sustainable?***

TAFEA PROVINCE

The crops/materials of most importance for climate change adaptation in Tafea province include the following Yams, Island Taro, Kumala, Manioc, Bullock, Goats, Chicken/ ducks, Fruits/nut trees, Native species, Natangura, and Vetiver Grass. The materials will be placed in multiplication plots, field trials and with lead farmers.

Institutional actors that should be involved in the planting material dissemination to ensure sustainability include the Provincial staff, Area Administrators, Farmers associations, Agriculture, Livestock, Forestry, Communities, and key farming households. The actual management of the programme however will be undertaken by the Provincial Government and relevant department staff in conjunction with specific Agricultural or forestry field Associations.

Sustainability will require a mixed set of activities including enhanced human resource technical support, funding and small grants, departmental mainstreaming of activities into daily work, departmental restructuring, and the use of multiple actors like volunteers and rural training centers. In order to fund the provincial nursery it is suggested that a trust fund be established, which will over time cover maintenance and upkeep costs. Farmers and individuals will also be expected to make contributions or pay membership fees in order to gain access to the materials.

The best approach to getting materials in the hands of farmers is to replicate the FSA/VARTC, forestry and agriculture nurseries at various sites in TAFEA province. To

accomplish this, training, transfer knowledge and technologies are required by provincial actors at all levels. Effective ways to pass information in Tafea include:

- Existing government/provincial networks
- Farmers networks
- Freight(air/seas/land)
- Internet/ email/teleconference
- Individual key farmers- word of mouth
- NGOS eg. Vanwood
- "My time" radio network.
- VBTC FM 107/104
- Big public events, celebrations and ceremonies

The costs of effectively establishing such a programme on Erromango for example, would cost approximately 20 million vatu.

SHEFA PROVINCE

In Shefa province the best approach to get planting materials and technologies in the hands of farmers is primarily by using the established provincial governance structures, but also by ensuring that VARTC technical staff are able to work with government extension officers who in turn work with communities. The most important area for planting material dissemination in Shefa should focus on Climate-related agricultural diseases and insect tolerant species and varieties. The most appropriate way to get information out to farmers in Shefa is through leaflets, brochures, posters, DVDs, and radio announcements/shows.

In Shefa distribution centers should be located in particularly vulnerable sites, such as the small islands of the Shepherds (Mataso). It is expected that with government technical support, the local community could realistically manage and implement a planting material nursery. To ensure sustainability a baseline survey should be carried out which examines the distribution site characteristics including required nursery materials/equipments, labour costs and availability, transport context, need for training and awareness, and the existence of sharing of existing planting materials.

PENAMA PROVINCE

A Central nursery will be located in Saratamata and another in Pentecost, Maewo, Ambae (west). The species to be propagated include: Root crop, Cash crops, and Tree crops. The following must be considered in order to make climate resilient planting materials available: . Air, sea land transport, Nurseries, Land, Seeds/cuttings/suckers, Workers/training farmers/ field exchange, Transport/ motorbikes/boat, Staff nursery workers, Water irrigation, and Information food distribution awareness. In general nurseries should be managed by AFA/FFA. Sustainability could be achieved by selling planting materials to farmers at a reasonable price, identifying and working primarily through key farmers, and strengthening capacity of these individuals.

TORBA PROVINCE

In Torba, farmers will collect and distribute climate resilient planting materials via multiple transportation methods (air, land, sea) and cost will be an issue. Multiple networks will be used including farmers associations, community disasters committees (provincial disasters), provincial government (area councils) and Other community NGOS. The climate crops of most importance to Torba include that could be propagated: Navia, Wild yam, Wovile and Fiji Taro. Some new varieties that should be introduced include: Kumala, Manioc, Yam, Taro. Mechanisms of information and distribution include: Field days, Set up demonstration plot, Farmers Training, Free planting materials to farmers, or perhaps subsidized. Farmers associations would be responsible for managing the propagation programme, perhaps by training and employing a full time worker. Ideally, a climate nursery must be located on each island. Costs will be high and include, Labour cost, Nursery establishment, Transport (boat fuel air freight (plane), Training, Field trips days and Set demonstration plots.

MALAMPA PROVINCE

In Malampa the distribution programme would work with existing nurseries (Government Nurseries in Lakatoro, Farmers Associations & through Key Farmers) to increase capacity (human resource, financial resources, technical support and materials) and improve nurseries (irrigation, standout beds, germination box, polybags, seeds etc..). Crops would be selected based on the suitability and relevance for each area and crops supported by existing nurseries. The programme would be facilitated by key farmers hoping that other

local farmers will access from them in turn. They would be provided with planting materials along with short and continuous, and care would be taken to maintain linkages with key lead farmers/associations. The Government depts. In the province, key lead farmers, and associations would all have an important role to play. The main provincial nursery would continue to be at Lakatoro, and 10 additional small nurseries in the 10 area councils of Malampa would be established. A proposed budget for five year might include:

Budget:

a. Transport: 2 boats, 1 4X4 land cruiser: 7,000,000VT
b. Awareness: 3,000,000VT
c. Follow up Monitoring: 5,000,000VT
d. Establishment: 12,000,000VT
e. Materials: 5,000,000VT
f. Training/capacity building 12,000,000VT
g. Equipment 6,500,000VT

Total: 50,500,000VT (5 years)

Note: Awareness materials include: posters, brochures, media (radio, newspaper, meetings/awareness). Follow up monitoring: 3X per annum. Establishment includes: building materials, Materials: CC planting materials for agriculture and livestock. Training includes capacity building-attachment 1 officer per year, training 3X per annum. Equipments includes a tractor, lawn mower, mini-rotavator

SANMA PROVINCE

In Sanma province, climate resilient varieties would be collected materials from selected farmers and research stations throughout Vanuatu (VARTC, VAC, RTCs, DoF Seed Storage). A distribution network would be established in the province, highlighted by annual festivals, agriculture shows. Of primary importance would be Food crops, timber tress, fruit/ nut trees, and coastal species. Government and NGOs would be expected to design and implement a comprehensive awareness program. A vehicle would be required to transport planting materials to farmers. In Sanma all relevant departments (DARD. DoF, VAC) would

be participants in the programme, with a geographic focus for the nursery at the Agriculture Station, Chapui-Santo. A rough budget of around 12,000,000VT per annum would be required to cover plant collection, awareness, nurseries, tools, materials, transportation. The programme could be sustained through involvement of relevant depts. Workshops/awareness, capacity building trainings, follow ups, monitoring & evaluations should be undertaken that will feed into the design of future projects.

Appendix ENSO Booklet

An ENSO handbook has been developed as an outcome of this summit, which contains detail information about El Nino southern Oscillation (ENSO) and how it affect different sector of Vanuatu. It is action oriented and intends on providing a guide to farmers and extension officers alike on how to react to extreme events caused by ENSO. Given that ENSO can be predicted with some level of certainty, the booklet will complement the ENSO Early Warning System set-up by the VMGD to inform sectors and in this case, land based sectors. The booklet can also be used by civil society organizations which work with communities to carry out some basic activities especially during an ENSO event when warnings are issued.

The ENSO booklet is a collection of information from the communities throughout Vanuatu on what and how they react to extreme weather/climate events. Most of the events can be characterized by the 2 ENSO phases. It was first collated as a book in the December 2010 workshop where farmers revisited the document and provided more in-depth discussion. In 2011, VMGD reviewed the document for the March 2012 workshop where it was presented. The concept is widely endorsed by participants to the workshop and carries the support of four directors and their extension officers. VARTC also plays a very important role in ensuring the quality of the document.

The handbook is expected to serve as a guideline to farmers and other provincial sectors especially during ENSO events. Most of the information included is in the form of guidelines and instructions on what actions the farmer should do. It is based on the seasonal forecast outlook about weather conditions that may happen for a period of three to six months using a SCOPIC. It was agreed during the meeting that the SPC factsheets for Livestock will be included into the booklet to have more relevance and applicability.

Appendix: Products and Services of the VMGD

The Vanuatu Meteorology and Geo-Hazards Department (VMGD), previously known as Vanuatu Meteorological Service, has recently undergone an institutional restructuring. This involved the amalgamation of a geo-hazards section which was previously with the Ministry of Lands. This Division oversees and monitors geo-hazards activities (volcano, earthquake, and tsunami) in the country. The new institution Vanuatu Meteorology and Geo-hazards Department (VMGD) still holds its original responsibilities as well as the added responsibilities of Climate Change and Geo-hazards. Moreover, the newly established department also houses the National Disaster Management Office (NDMO) for easy coordination of disaster monitoring, risk reduction, and recovery.

Given the geophysical and meteorological hazards associated with Vanuatu's geographical location, the VMGD is mandated by the government to provide timely information on natural hazards (geo-physical and meteorological) to facilitate decision-making in different sectors. There are several services and products developed to inform people.

The products from the different sections include:

1. *Observation Division*
    a. Metars
    b. SPECI
    c. Observation of weather 24hr

2. *Forecasting Division*
    a. Tropical cyclone monitoring and warnings
    b. Public weather information
    c. Marine Services
    d. Aviation Services
    e. Tsunami Warnings

3. *Geo-hazards Division*

Volcano Monitoring

    a. Earthquake Monitoring
    b. Tsunami Early Warning System
    c. Volcano Ash Advisory

4. *Climate Division*
    a. Manage the Vanuatu National Rainfall Network (VRN)
    b. Seasonal forecasting
    c. ENSO Early Warning System
    d. Analysis and Research on Climate and climate changes
    e. Awareness
    f. Database Management