
2013 Agro-Meteorology Summit
Final Report

**National Conference to Disseminate Adaptation Technology and Practice
in Climate Services and Agricultural Resilience**

Theme: Building Community Resilience through Weather and Climate Information



**20-24 May 2013
Tanna Island, Vanuatu**



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

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Background

The Vanuatu Meteorological and Geo-hazards Department (VMGD) and the National Advisory Board on Climate Change & Disaster Risk Reduction (NAB), hosted a 5 day Agro-meteorology Summit AND Climate Field School for over 100 government extension officers for the land based sectors (Agriculture, Forestry, Livestock and Environment) on Tanna Island in 20-24 May 2013. The summit focused on practical adaptation strategies to climate and climate change in Vanuatu particularly in the agriculture and land based sectors .

The objective of the summit and field school was to provide technical know-how on agriculture sector adaptation in Vanuatu and giving a practical context to the implementation of the Global Framework on Climate Services (GFCS). The summit provided a platform wherein extension officers from the land based sectors (Agriculture, Forestry and Environment) and key farmers directly engaged with ni-Vanuatu Agro-meteorology experts to share ideas and dialogue on important agro-meteorology products such as seasonal forecasts, crop advisories, and ENSO guidance handbooks.

Equally important, this summit supported Vanuatu in meeting its international climate and climate change obligations, specifically those under the World Meteorological Organization¹. After this summit, participants better understood climate variability and learned how to implement tailored solutions for local contexts. Seasonal forecasting tools were disseminated to help sector specialists in their preparation for future challenges posed by climate change and extremes.

Summit Coordination and Participations

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

The summit was organized through the financial support of:

European Union (EU-GCCA)

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

¹The World Climate Conference-3 (WCC-3) with the establishment of a **Global Framework for Climate Services (GFCS)** required Met Services to integrate climate information and products into decision-making in all socio-economic sectors, through an effective two-way dialogue between providers and users.

And the in-kind support from

Vanuatu Meteorology and Geo-hazards Department

The workshop participants included representatives from;

- Ministry of Climate change, Energy and Environment
- National Advisory Board on Climate Change & Disaster Risk Reduction (NAB):
- Vanuatu Meteorological and Geo-hazards Department (VMGD)
- Vanuatu Rainfall Volunteers (VRN)
- Department of Agriculture and Rural Development (DARD)
- Local farmers
- Department of Forestry
- Forestry farmers
- Department of Livestock
- Livestock farmers
- Vanuatu Bio-security
- Department of Environment and Conservation
- SPC-GIZ:
- Vanuatu Agriculture Research and Technical Centre: (VARTC)
- Vanuatu Chamber of Commerce and Industry
- Local NGOs: Farmers Support Association (FSA), Tanna Nikolatan Council of Chiefs, Niko farm.
- Regional Institutions
 - SPREP (Samoa)
 - SPC (Fiji)
 - World Bank

The detailed list of participants is attached in the Appendix

Overall Objectives

The overall objectives of the summit were as follows:

- **Train:** Officers to better understand the concepts of climate variability/ENSO and agro-meteorology
- **Identify:** Opportunities to develop agro-meteorology products and services useful to Vanuatu stakeholders
- **Review:** Mechanisms to effectively deliver practical agro-meteorological and climate 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
- **Practice:** Strategies for climate change adaptation options for different crops, trees and animals
- **Update:** Traditional Cropping calendars from each Province and integrate them with meteorological information
- **Recall:** Specific climate impacts events in Vanuatu's recent history
- **Prioritize:** Dissemination and capacity building needs around specific adaptation technologies

Outputs from Workshop

The outputs from the summit form an important body of materials for future implementation of climate adaptation and readiness and are built on Vanuatu's previous Agrometeorology summits and activities under the GFCS.

Output 1: Vanuatu ENSO timeline with narrative stories and memories

Output 2: Narrative and Stories of CC Impacts on the Agricultural Sector in Vanuatu

Output 3: Organizational action statements on using/accessing Agro-meteorology information

Output 4: Organizational aspiration statements on expectations from national Agro-meteorology Summits

Output 5: A list of specific ways and examples that climate services and early warnings can be useful to the agriculture sector (including suggestions on timing and presentation of products)

Output 6: Updated seasonal planting calendars to integrate met/climate information and planning entry points

Output 7: Notes and recommendations for dissemination of each adaptation strategy

Output 8: Bislama Language DVD on Agro-meteorology for Climate Change Adaptation

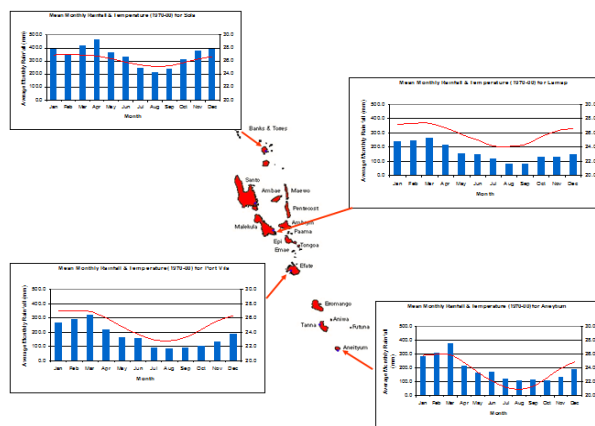
Output 9: Guidance document on National Climate and Climate Change Field Schools in Melanesia

Format of discussions and list of speakers/panelists

VMGD invited representatives from land based sectors, and a number of expert speakers to make presentations and sit on panel discussions and group activities targeted at achieving specific outputs. The workshop also included brainstorming discussions, hands on training and field school activities, and field trips.

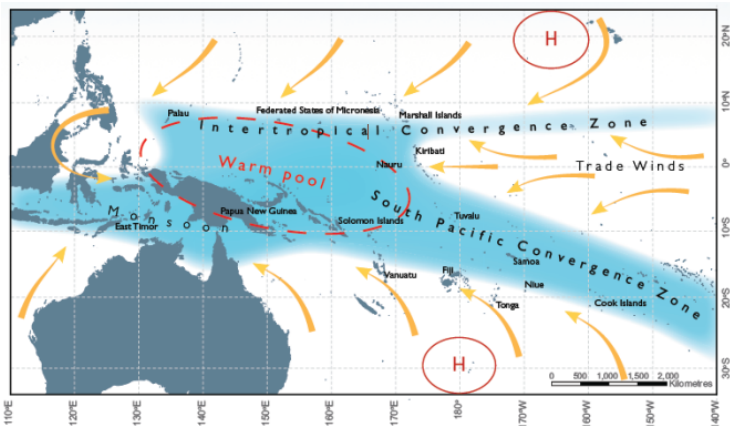
Climate change, Variability and Extremes

Across Vanuatu the average temperatures range 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



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.

ENSO in Vanuatu

El Niño-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.

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.

- 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.

	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
High emissions scenario	0.4–1.0	1.1–1.7	2.0–3.2

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*)

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 Oscillation².”

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.

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



Port Vila SEAFRAME Gauge installed in 1993

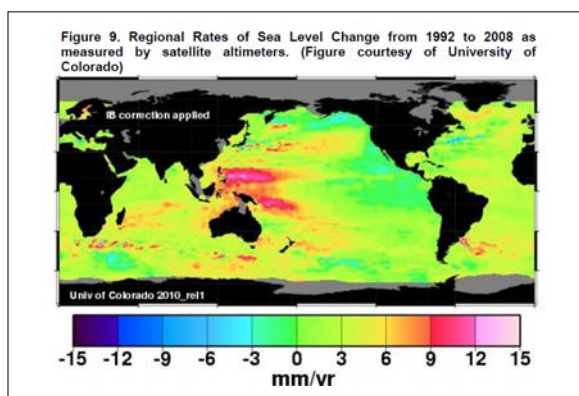
²Church et al., 2006, p. 157

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.

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).

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**³. This is also confirmed by a separate report⁴ that put sea level rise in Vanuatu at 5.6 mm per year (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

	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

³PCCSP Vol 1 Country Reports, 2011

⁴AusAID, 2007

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.

Sectoral Updates on Climate Change & Climate Variability

After the Santo summit 2012, time was given to recognize and acknowledge progress made by stakeholders in each sector. Participants heard from sector representatives on what has been done, future directions of their department and how climate services can further improve their service delivery.

1. Agriculture

Background

Agriculture is a vital sector to the nation's development, given the involvement of a significant proportion of Vanuatu's population in farming for their livelihood. Accordingly it is equally important that adaptation to climate change and variability be integrated into farming practices to enhance sector resilience. DARD's status update focused on items in a previous MOU signed between DARD, VMGD and GIZ at the 2012 Agro met Summit in Santo regarding climate services and helping the agriculture sector to improve its' extension services.

Issue

- MOU sought to ensure that climate information and climate services reach the last mile.
- Information collected by extension officers in the field are still not shared with the Met Department as outlined in existing MOA
- Absence of national agriculture policy and human resource constraints has impacted on the ability of the Department to fully meet obligations under the existing MOA and comprehensively engage with VMGD and GIZ (e.g. staff liaison/exchanges)

What has been done

Information dissemination to the Last Mile

- Vanuatu climate updates (produced by VMGD) are disseminated through the department and transferred to farmers

- Farmers are advised on climate and climate updates by extension officers e.g. what type of kumala to plant or farming system to use under certain climate conditions
- DARD, VMGD and GIZ developed & validated an ENSO early warning system handbook
- DVD was produced after Agro met summit in Santo, now used in current awareness activities
- DARD is currently implementing 5 climate change projects including the World Bank (IRCCNH). In addition to GIZ, the NARI project is also assisting the department undertake certain activities/tasks as outlined in the MOU
- Farming system demo plots established and manuals developed with assistance from SPC-GIZ
- Alley cropping or agro forestry being encouraged in locations with considerable population numbers as means of maximizing production and enhancing soil nutrition where farmers have limited land such as in Teouma (Efate) - Trialing use of thermometers, rain gauges and other meteorological devices in a number of farm plots by SPC-GIZ and NARI.
- Organized along with VMGD and GIZ, a farmers' field school on Pele Island last year, demonstrations done particularly in grafting techniques.
- Produced 4 vegetables leaflets with SPC-GIZ & NDMO (particularly with information derived from post cyclone assessments). Disaster relief seeds were distributed in Lenakel, along with the dissemination of leaflets (for cucumber, water melon, capsicum and dwarf bean) outlining specific adaptation measures.
- Use of DARD "Talemaot" newsletter to highlight and promote climate change issues

Reporting & Documentation

- Establishment of evaluation plots to increase holding nurseries of climate resilience crops. NARI-ACP project in particular provides avenues for capacity building especially in training officers in evaluating root crop varieties and plots suitability to climate conditions e.g. kumala
- Assisting VMGD, VKS, SPC/GIZ in collection of traditional indicators to contribute to traditional knowledge framework. Participated in pilot study in Port Resolution.

Training & Development

- VMGD trained DARD staff on how to translate seasonal forecast information so that such information can be conveyed to farmers
- Various officers have attended trainings or workshops e.g. in Fiji, China
- Establishment of rain gauges under NARI project in sites such as Malafao and Siviri – current
- Challenge: when the original MOA was signed the department was considering restructuring which would have enabled the realization of substantial items under the MOA. This however did not eventuate and with the current absence of a national agriculture policy the task of mainstreaming agromet (climate) duties into job descriptions did not fully materialize.
- Shortage in staff also meant that there was no staff attachment/liaison with VMGD. Coordination an issue. Need human resources
- Current working relationship between DARD, GIZ& VMGD is very good.

Vanuatu specific actions/Recommendation

- No officers to oversees the **work of Agromet work in DARD. There is an** Urgent need to have an agromet liaison officers (VMGD or DARD)
- Dissemination from VMGD to Famers is a challenge i.e. how the information disseminated and the need to simplify the technical terms into simple/daily used language e.g. the use of probability terms such as most likely, likely etc in 3 monthly outlooks. Farmers require clear explanations on what these terms or information mean.
- Staff attachment/exchange between VMGD and DARD will allow for much more effective dissemination of climate information to farmers

How Climate Services can improve DARD service

- Need to reassess and fully achieve provisions under the current MOA between VMGD, GIZand DARD

Next step

- New programs and projects should address key agriculture priorities as identified by DARD in interim Climate Change & Agriculture Directive. Priority now is to consider climate resilient crops and those that are economically viable as well.
- Policy paper now developed, with climate change and DRR considerations

2. Livestock

Background

The Livestock Department undertakes the following activities as part of its' mandate:

1. Promotes cattle development.
2. Promotes small livestock (pigs, poultry, goats) production throughout Vanuatu.
3. Facilitates linkages (communication) between farmers, restockers and market outlets.
4. Supplies genetically improved breeding stocks to smallholder farmers.
5. Promotes of Feed silage and pasture species.

Key points/What has been done

A number of avenues are currently used by the Livestock Department to disseminate climate change related information relevant to their sector. These namely entail the following radio programs:

- Tokraon long Economy
- Agriculture Toktok – Agriculture Dept.
- Talk back show – Every Tuesday – Focus on issues on Agriculture, Forestry, Fisheries, Livestock & Biosecurity.
- Livestock / Biosecurity Toktok – Every Sunday

Vanuatu specific actions/recommendations/Future directions

Future developments whereby assistance is required from VMGD relative to enhancing the Livestock Department's activities should be guided by the following strategic documents;

- National Livestock Framework (NLF)
- Corporate Plan
- Business Plan and Annual work plan

3. Forestry

Background

Forests play a significant role in the livelihood and well being of Ni-Vanuatu. Ecosystem support services and goods provided by forests include clean and air, soil fertility and stability, medicine, food, shelter, building materials and income. Seventy five percent (75%) of Vanuatu's land cover is natural vegetation. Of the total land area, there is 6915 ha of declared protected areas and 10,000 ha of planted forest. The Department of Forests accordingly aims to have 20,000 ha of planted forests by 2020 and have also proposed for a further 23, 174 ha of forest conservation areas.

Climate change impacts in this sector include changes such as;

- Temperature stress leading to damage of healthy mother trees and changes in both flowering and fruiting seasonality and success.
- Heart rot caused by cyclones.
- Forest growth die-back
- Restricted distribution of indigenous species which can either proliferate or become extinct..
- Spread of invasive spp
- Temperature increase-modify functioning & composition of forest
- Forest fire
- Slow progress of natural regeneration.
- Invasion of weeds and vines in forested areas.
- Landslides and coastal erosion.
- Soil moisture- delay of plant growth in some areas.
- Increased CO₂-influence on forest productivity
- Seasonal patterns in ecosystem processes altered

Key points/What has been done

- There a number of adaptive measures being promoted by DoF given various climatic changes and stressors.
 - Adaptive measures given temperature change and increased rainfall
 - Conduct assessment of species severely affected.
 - Collect seeds, wildings or cuttings from healthy tree species affected.
 - Raise seeds in a nursery as promoted by DOF
 - Plant seedlings in other locations not affected

- Relocate plants affected in swamps and wet land areas to seasonal waterlog areas.
 - Propagate plants to increase planting materials when long wet seasons affect their flowering.
 - Collect seeds and store them in safe and climate controlled rooms or coolers to be used during low fruiting periods
 - undertakes assessments to determine appropriate seedlings or tree species to plant in a climate affected area.
- Adaptations for decreased rainfall and increased temperature;
 - Establish sites specific guidance for each species to ensure planting in right location and climatic zone.
 - Identify and relocate important species to wetter locations.
 - Plant tolerant species of high temperature.
 - Promote grafting of tree species to ensure fruiting under controlled conditions.
 - Build storages facilities to store seeds for future use.
 - Use the agro-forestry method.
 - Undertake awareness on the risks of forest fires.
 - Encourage communities to rehabilitate water catchment areas through tree planting and general awareness.
 - Adaptive measures for soil erosion
 - Conducted logging operations only in dry periods.
 - Discourage heavy machinery operation during rainy seasons.
 - Comply with all the Vanuatu Code of Logging Practice (VCOLP) requirements and specifications.
 - Discourage gardening and clearing of vegetation on steep slopes
 - Revegetate and rehabilitate sloping and eroding areas (e.g.withvertiver grass)

- Tropical cyclone adaptations
 - Plant local species (5 priority local species) that are more adapted to cyclonic stress.
 - Establish green belts or wind breaks around forest plantations.
 - Establish seed orchards in secured locations.
- Adaptations for coastal areas
 - Plant coastal trees along the coastline to control erosion.
 - Establish forest buffer zones between coast and villages.
 - Establish forest plantations in areas less affected by cyclones for improved wood quality.
- Sea level rise measures
 - Relocate species of importance to higher grounds
 - Identify and rehabilitate coastal sites
 - Establish a buffer of coastal species to reduce the rate of coastal erosion.
 - Develop coastal management plans

Vanuatu specific actions/What can the climate services do to improve forestry services

- Establish direct and regular contact with the climate section of VMGD i.e. establish MOA between Forestry and VMGD
- Develop and disseminate weather updates and guidance on appropriate forestry operation timing especially to guide planting when there are hot or rainy periods
- Identify climate change affected areas, and advice DoF on appropriateness of its' activities in such areas
- Develop publication materials on species suitable for different climatic conditions
- Assist in pilot project sites – trialing certain species to withstand certain climatic condition
- Collaborate on frequent training and awareness on different effects of climate change among VMGD, GIZ and Forestry Department

Next step/Future direction

DOF's future goals directions are outlined as follows:

- Trees and forests of Vanuatu are sustainably managed and conserved

- Sustainable forestry is widely practiced including the management of natural and planted forests
- Effective management and protection of conservation sites
- Implementation of the National Forest Policy particularly to facilitate the role of forest sector in climate change mitigation and adaptation. DOF now has a dedicated officer to deal with climate change issues.
- Nursery Establishment to continue propagation of species and enable increased seedling production and distribution
- Commencement of national Reforestation Programme to target affected areas
- Develop strategies and policy as a guideline so that the Forestry Sector improves its' activities
- Apply traditional adaptation methods
- Ensure that it is widely seen as everyone's ethical responsibility to be good managers and stewards of the environment

4. Quarantine (Bio-security Vanuatu)

Background

Bio-security Vanuatu (formerly known as the Vanuatu Quarantine Service) is largely involved in matters of plant and animal protection issues, especially the control of pest or invasive species. Climate change in particular is providing an additional challenge. Climatic changes may aid the proliferation of non native plant and animal species and increase their impacts on ecosystem health and traditional agricultural indicators.

Key points/What has been done

Subsequent to the Santo 2012 Agro met Summit, Bio-security Vanuatu accomplished several tasks, including

- Assessment regarding the importation of turf grass (*Spinifex sp.*) for the management of beach sand erosion in some plots;
- Facilitation of the importation of improved planting materials, such as assisting Agriculture Department in importing disease resistant plant varieties.

- Facilitation of the importation of improved semen (cattle, pigs) from New Caledonia and Australia.
- Radio talk back shows regarding the spread of pests and diseases during long rainy and sunny period.
- Implementation of biological control of invasive weeds program (funded by Ausaid), targeting eight invasive plant species such as mile a minute, broom weed and water hyacinth. Program is currently undertaken on Tanna, Malekula, Santo, Epi and Efate.
- Introduced toxic weeds are becoming a problem for the cattle industry, especially on Efate and Tanna as they can cause death when consumed.
- Field visits are done to assess various weed problems and control the weeds using biological control agents
- Proposal now in the pipeline to address the *phytophthora* disease affecting oranges on Aniwa Island through application of grafting techniques.

Next steps/how can climate services improve bio-security activities

Bio-security Vanuatu recommends that climate change funds may support :

- On-going facilitation of importation of improved and safe planting materials and animals semen
- On-going border control activities to stop the introduction of pests and diseases into Vanuatu.
- Management of *Achatina fulica* (Giant African Snail) infestation on Malekula.
- Studies on the *Eudocima fullonia*, *Quadrastichus erythrinae* and *Erythrinar variegata* population to find out whether there is need for the biological control of Erythrina gall.
- Management of wild peanut (Cassia tora) and other weeds in cattle farms through pilot activities

5. National Disaster Management Office

Background

The National Disaster Management Office (NDMO) is a department under the newly established Ministry of Climate Change. NDMO as established under the Disaster Act (Cap. 267) with the mandates of overseeing and managing DRR and DRM activities in the country. Coordination structures used by the NDMO cover all levels of governance with the National Disaster Committee (NDC), Provincial Disaster Committees (PDCs), and Community Disaster Committees (CDCs).

Issue:

- Information sharing and awareness; currently there is restructuring in the DRM sector to link national and provincial governments particularly to strengthen area council and improve information sharing
- Coordination; coordination and monitoring of agricultural programs or initiatives needs to improve
- Preparedness; strong need to further contribute to national agriculture and food security contingency planning
- Emergency action; the disruption in agricultural and food security services during emergencies needs to be addressed. This entails close liaison with government partners and regional support agencies e.g. FAO, OCHA and SPC
- Response; close collaboration with NDMO and other relevant partners is required to ensure there is coordinated response to food security and agriculture emergencies.

Key Points/What has been done:

- Since the 2012 Santo Agro-met summit, NDMO, VHT and GIZ have established a Food Security and Agriculture cluster⁵ with its' terms of reference and action plan.
 - Cluster system application during ENSO events serves to increase resilience and improves humanitarian support systems. This is namely realized by increasing coordination, planning and lessons learned from DRR, Preparedness and Response actions.
 - Government ministries take the lead and supported by co-leads in cluster coordination.
 - VMGD and NDMO plays a key role in providing technical information to an ENSO committee. Accordingly information and directives from ENSO committee are disseminated to the various clusters.

Next step/Future directions:

- Facilitate the effective sharing of information among agencies (government and other organizations) involved in food security, DRR, disaster preparedness, climate change adaptation and early recovery initiatives

⁵The cluster system is a collective grouping of organizations with thematic responsibilities related to humanitarian response, namely relief assistance, camp coordination and early recovery and protection. Other focal clusters are the WASH, Education, Health and Logistics.

- Improve coordination, steering and monitoring of agricultural initiatives or projects with the support of VMGD, NDMO, GIZ, VHT, NAB and other clusters

Vanuatu Specific actions/Recommendation:

Climate services can assist the NDMO improve its' services by:

- Developing common data sets i.e. in areas of mapping, monitoring and evaluating risks associated with slow onset disaster such as drought and flooding.
- Provide seasonal rainfall calendars which can be disseminated to communities.
- Enhance the timely dissemination of emergency alerts and information to at risk communities especially in the events of tsunamis

Agro-Met summit overall recommendations and way forward

Overall this summit was deemed a major advance for the land based sectors on practical adaptation strategies to climate and climate change. The next national agrometeorology summit is planned to take place in three years time (2016) to allow time for further implementation of activities.

The following recommendation provide the way forward from this agro-met summit which can help achieve specific goals and get more hands-on activities done at the community level.

1. Agro-Met Summit Experience (from 3 years), 2011-2013: it is expensive to host such event annually. Therefore it is recommended that this activity will be organized every three years and in between there will be an agromet technical team that visits islands to run climate field schools. The next agro-met summit will be in 2016
2. Agro-Met summit products- and outcomes can be implemented in short, medium and long term so the proposed timing will allow for such implementation
3. A new direction towards location specific priorities, training and action. Match tailored solutions to real island needs and realities. There should be a renewed focus on provincial level agro-met priority plans.

4. Proposed approach for next year: Teams (including VMGD and sector extension officers) to visit communities to build capacity on agro-met issues and demonstrate techniques directly to farmers and community stakeholders.

* In one year, small teams can visit many more farmers for the same cost.

5. Agro-met stations to be more widely developed, including climatology instruments (rain gauges and thermometers)
6. More emphasis should be placed on crop modeling and agro-met data analysis to support agricultural decision making (long term goal)

Appendices

Appendix I: Summit Agenda

Day 1 – Monday 20 May 2013 (Opening, Meteorology, Climate and Climate Change)

07.30	<i>Participants assemble at Chief's Nakamal</i>	<i>Chair: Malcom Dalesa, PMU</i>
07.30	Registration	<i>All Participants</i>
	Welcome of Minister and delegation	
08.00	Prayer	<i>Father Charles. L</i>
08.15	Opening comments	<i>Jotham Napat, Chairman, National Advisory Board on Climate Change & Disaster Risk Reduction</i>
08.20	Keynote address	<i>Minister</i>
08.40	Introduction to program, objectives and goals of national conference	Phillip Malsale (VMGD)
09.00	Morning tea	
	GROUP PHOTO	
09.30	<i>Introduction, Climate Science and Services</i>	<i>Chair: Jotham Napat, VMGD Director</i> <i>Scribe:</i>
09.30	Introduction of Participants	All
09:45	Report on Outcomes and Products of 2011 and 2012 Agrometeorology Summits	Christopher Bartlett

10:00	<p>5 minute updates from sectors on Agromet accomplishments since 2012 summit.</p> <ul style="list-style-type: none"> -What has been done -Future directions of their department -What can climate service do to improve their services 	<p>Sector Representatives</p> <p>Agriculture – Peter Iesul</p> <p>Livestock – Lonny Bong</p> <p>Forestry – GodiBome</p> <p>Quarantine - Silverio</p> <p>NDMO: Philip Meto</p>
10:30	<p>Climate and ENSO in Vanuatu</p> <p>Group Exercise on ENSO – Historical Memory</p> <p>Output 1: Participants Place Stories and Memories on Vanuatu ENSO timeline</p>	<p>Philip Malsale</p> <p>Mike Waiwai (VMGD)</p>
12.00	Lunch	
1:00	Climate Change in Vanuatu	Philip Malsale (VMGD)
1:45	<p>Group Exercise on Climate Change – Historical Memory</p> <p>Output 2: Participants give specific examples of climate change impacts in the agricultural sector.</p>	<p>Philip Malsale</p> <p>Mike Waiwai (VMGD)</p>
2:30	<p>VMGD Services and Products:</p> <p>ENSO Handbook, Rainfall Outlook, Agrometeorology Bulletin, Warning Procedures</p> <p>Launching of ENSO Handbook</p> <p>Agriculture & Food Security Cluster, NAB Portal, DARD Newsletter, NAB Newsletter</p>	<p>Mike Waiwai (VMGD)</p> <p>Melinda Natapei (VMGD)</p> <p>Jotham Napat/Salesa Kaniaha</p> <p>Philip Meto (NDMO)</p> <p>Rebecca Iaken (NAB Secretariat)</p> <p>Christopher Bartlett (GIZ)</p>
3:30	<p>Group Discussions and Action Planning on Product Access and Usage</p> <p>Output 3: Participants give detailed recommendations and action plans for accessing and using VMGD resources</p>	Philip Malsale
4:30	<p>Individual Activity: Participant Expectations on Learning and Action</p> <p>Output 4: List of Key Concerns and Expectations to be met by end of Conference</p>	Elva Borja

17:00	Day 1 Close	
19:00	DOCUMENTARY MOVIE: An Inconvenient Truth	Optional

Day 2 – Tuesday, 21 May 2013 (Agro Meteorology & Livestock Field School)

07.30	<i>Climate Change and Agriculture</i> <i>Venue: Chief's Nakamal</i>	<i>Chair: Livo Mele, Director, DARD</i> <i>Scribe:</i>
07:30	Recap of Day 1	
07:15	Overview What is Agro-Meteorology? Opportunities in the Pacific. Group Discussion	Peter Napuat
8:00	Group Work: ENSO Early Warning Products, Climate Diaries and Best Practice/Specific Data Needs for Using Climate Services in Agriculture a) Crops b) Animals c) Trees Output 5: A list of specific ways and recommendations that climate services and early warnings can be useful to sectors (including suggestions on timing and presentation of products)	Phillip Malsale Melinda Natapei
9:00	Review of Traditional Crop Calendars & Meteorological Information for each Province	Peter Iesul (DARD) Christopher Bartlette
9:15	Group Work: Integrating Traditional Calendar, Meteorology and Planning Output 6: Revised Provincial Planting Calendars including Meteorology indicators, thresholds and planning entry points	Christopher Bartlette
10.00	Morning tea	
10:15	Update and Discussions on Traditional Knowledge and Climate Projects and Programs.	Mike Waiwai Christopher Bartlett

11:00	Overview of Planned Climate and Climate Change Field School Exercises: To include: farming systems, food preservation, livestock husbandry, forest management, conservation activities etc. And links to climate services	Christopher Bartlett Elva Borja
12.30	Lunch	
13:30	Discussion of framework for a proposal on GFCS activity	Salesa Kaniaha (SPREP)
14.30	<i>Field School Exercise</i>	
	Practical Field School Exercises in Climate Change Adaptation and Agrometeorology 1. Backyard Tilapia 2. Pig Food Silage	Glen Alo (Fisheries) Steve Boe (Livestock)
18.00	Day 2 Close	

Day 3 – Wednesday, 22 May 2013 Field School (Agriculture)

07.30	<i>Field School Exercise</i> <i>Venue: Chief's Nakamal</i>	Chair: Bae William
	Practical Field School Exercises in Agrometeorology 3. Yam Miniset Technique 4. Yam Vine Replication 5. Manioc Seeds	Tari Molisale (VRTCA)
10.00	Morning tea	

	Practical Field School Exercises in Agrometeorology 6. Taro Sexual Reproduction 7. Glyricidia 8. Mucuna 9. Organic Pesticides	Tari Molisale (VRDTCA) OneilDalesa (DARD) Willie Iau (DARD) Peter Kaoh/Olivier (FSA)
12:30	Lunch	
	Practical Field School Exercises in Agrometeorology 10. Bannana Preservation 11. Samoan Banana Replication 12. French Banana Multiplication	IssoNimehi/Thomas Putunleta (GIZ) Joseph Ala (GIZ) Sanford Nako (GIZ)
15.00	Afternoon Tea	
	Group Work: The Best and The Worst Technologies. Constructive Feedback on Vanuatu Application Output 7 & 9: Participants discuss the applicability of each methodology to Vanuatu stakeholders and give specific recommendations on how and to whom this technology should be transferred.	Elva Borja
17.30	Close of Day 3	
19:00	DOCUMENTARY: Climate Change and Food Security in Vanuatu	<i>Optional</i>

Day 4 – Thursday, 23 May 2013 Field School (Forestry)

07.30	Field School Exercise Venue: Chief Nakamal	<i>Chair: Jude Tabi, Forestry</i> <i>Scribe: Bae/Joe Mala</i>
	Recap of Day 3	
07.30	Field School Exercise	

	<p>Practical Field School Exercises in Agrometeorology</p> <p>13. Forest Nursery Establishment & Maintenance 14. Grafting/Budding 15. Rainfall Monitoring & Observation</p>	<p>Philemon Ala (Forestry) Jean Marc (DARD) Peter Feke (VMGD)</p>
10.00	Morning tea	
	<p>Practical Field School Exercises in Agrometeorology</p> <p>16. Composting 17. Establishing & Registering a Community Conservation Area 18. Land Use Planning</p>	<p>Carol/Isso/Joseph (DEPC/GIZ) Donna Kalfatak (DEPC) Emil Mael</p>
12:30	Lunch	
1:30	<p>Group Work: The Best and The Worst Technologies. Constructive Feedback on Vanuatu Application</p> <p>Output 7 & 9: Participants discuss the applicability of each methodology to Vanuatu stakeholders and give specific recommendations on how and to whom this technology should be transferred.</p>	<p>Elva Borja</p>
2:30	<p>Overview: National Climate Change & Disaster Risk Reduction Policy and the National Advisory Board on Climate Change & Disaster Risk Reduction</p>	<p>Malcolm Dalesa</p>
4:00	<p>Group Work: Recommendations on Agrometeorology for Policy</p>	
17.30	Close of Day 3	

Day 5 – Friday 24 March 2012 Sharing Experiences in Agrometeorology

07.30	Venue: Chief's Nakamal	<p><i>Chair: Malcolm Dalesa</i> <i>Scribe: Bae Williams/Joe Mala</i></p>
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07.30	Introduction to Climate Video Diary Exercise	<i>Christopher Bartlett</i>
8:45	Working Groups on Video Diaries Topics: a) Importance of Climate Services for Vanuatu farmers b) Tips and Tricks of Adaptation Technologies c) Historical Memory of ENSO and CC Impacts Output 8: Bislama-language video footage for a DVD on Vanuatu Agrometeorology to be produced by GIZ	<i>Christopher Bartlett</i>
10.00	Morning tea	
10.30	<i>Working Groups on Video Diaries</i>	
11.00	Closing of Workshop	
	Presentation of workshop outcome	Phillip Malsale, Malcolm Dalesa
	Closing Remarks	Jotham Napat, NAB Chairman
	Finals Remarks and Official Closing	SG TAFEA Province
	Closing Prayer	
12.00	Workshop Closed	
5.00	Closing Diner	All

Appendix II: Participation List

	Participant Name	Organization	Contact	Email
1.	Hon. Thomas Laken	MCCEE	-	-
2.	DG – Jotham Napat	MCCEE	24686	jnapat@meteo.gov.vu
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34.	Bob Y	Rainfall Collector VMGD	5656757	-
35.	Sylvie Sam	Rainfall Collector VMGD	5699530	-
36.	Barton Bisjewel	DARD	5560072	-
37.	Gilbert Nari	-	-	-
38.	Ian Wilson	-	-	-
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40.	Henry Hilton	VMGD	7739589	-
41.	Allan Vira	Forestry,	5377649	allanvirao2@gmail.com

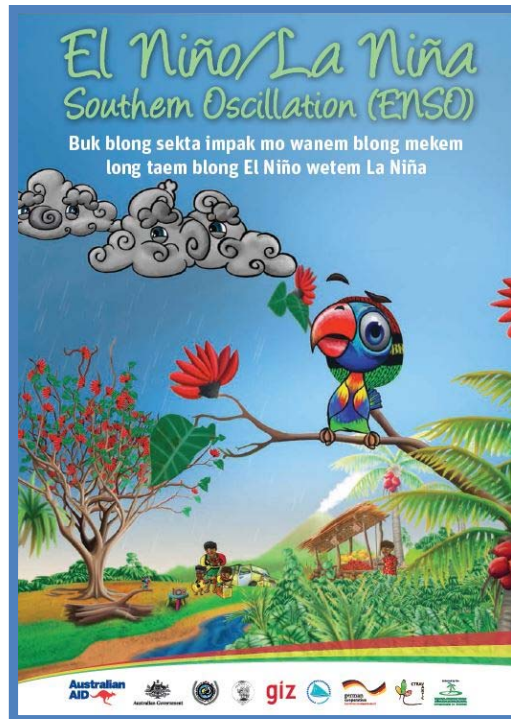
		Santo		
42.	Sam Naiu	DARD	7763689	-
43.	Austin Boe	Farmer	5393463	-
44.	Kevin Aru	-	-	-
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56.	KalpauLunapek	Farmer	-	-
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74.	Peter Napwat	-	5485801	nikamatua@gmail.com
75.	Andrew Iawak	-	7715364	-
76.	Thomas I	Quarantine	5445403	-
77.	Steve Boe	LD	7745948	sboe@vanuatu.gov.vu
78.	Richard Narinam	DARD	5925944	rnarinam@vanuatu.gov.vu
79.	Chief Willie Yata	Niko Farm	7742692	-

80.	Sanford Nako	SPC-GIZ	29594	sanfordnako@gmail.com
81.	Marie Rossetti	DEPC		marie.rossetti@sciences-po.org

Appendix III: Launching of ENSO Handbook

The ENSO handbook has been developed as a results of the outputs of the 2011 and 2012 agro-meteorology summits with additional pictures and artistic illustrations to ensure that activities are well understood by readers. The handbook is written in the Bislama language to ensure maximum comprehension. The ENSO booklet is a collection of information from communities throughout Vanuatu on how and when 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 a GIZ climate adaptation 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 local stakeholders and carries the support of four Government department directors and their extension officers. The final validation of the booklet was done by GIZ, DARD, VARTC and VMGD in 2013. The launching of the ENSO handbook was completed during 2013 Agro-met summit on Tanna. The final ENSO book design and formatting was made possible through the ENSO animation project funded by AusAID.

The ENSO 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 before, during and after an ENSO event. It is based on the seasonal forecast outlook about weather conditions that may happen for a period of three to six months in advance using SCOPIC projection software. It was agreed during the meeting that the SPC-GIZ factsheets and information for Livestock will be included into the booklet (which currently only includes agriculture and forestry) to have more relevance and applicability.



Appendix IV: Training Guides for Climate Field School Techniques

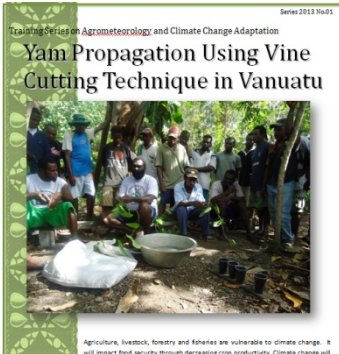
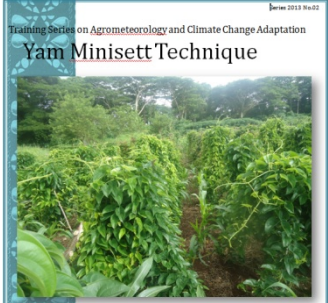
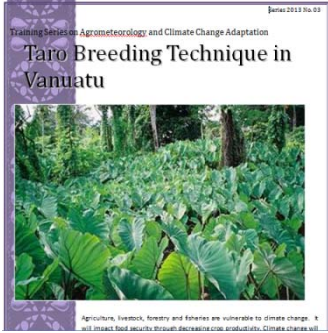
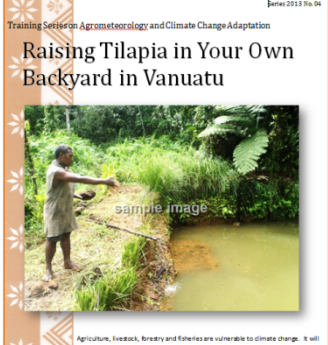
As part of the climate change field school, a series of training guides has been developed to give practitioners simple written reminders on key adaptation practices. A total of nine specific guides on farming techniques in agriculture, forestry and livestock were developed by an external consultant to support the climate field schools. The guides incorporate both new and traditional climate adaptation practices.

The guides complement a series of climate adaptation manuals which have been developed by the SPC-GIZ Vanuatu program including:

1. Sweet Potato Silage (for pigs)
2. Forest Nursery Development and Maintenance
3. Coastal Erosion Control
4. Citrus Grafting
5. Samoan Banana Replication
6. Banana Preservation
7. French Banana Replication
8. Climate Change Adaptation for Smallholder Bee Farming in the Pacific
9. Climate Change Adaptation for Smallholder Cattle Farming in the Pacific
10. Climate Change Adaptation for Smallholder Chicken Farming in the Pacific

11. Climate Change Adaptation for Smallholder Pig Farming in the Pacific
12. Climate Change Adaptation for Smallholder Goat & Sheep Farming in the Pacific
13. Climate Change and Livestock in the Pacific Island Countries and Territories

The guides developed specifically for this field school include:

Series	Volume No.	Title	
2013	No. 1	Yam Propagation Using Vine Cutting Technique	
2013	No. 2	Yam Minisett Technique	
2013	No. 3	Taro Breeding Technique	
2013	No. 4	Raising Tilapia in Your Own Backyard	

2013	No. 5	Dune Vegetation Planting for Coastal Rehabilitation	
2013	No. 6	Setting up Community Conservation Areas	
2013	No. 7	Backyard Pig Farming	
2013	No. 8	Backyard Chicken Farming	

2013	No. 9	Cattle Farming	 <p>Series 2013 No. 09</p> <p>Training Series on Agrometeorology and Climate Change Adaptation</p> <p>Small-scale Cattle Farming in Vanuatu</p> <p>Agriculture, livestock, forestry and fisheries are vulnerable to climate change. Climate change will impact food security due decreasing animal productivity.</p>
2013	No. 10	Farm composting	 <p>Series 2013 No. 10</p> <p>DEEP-LITTER SYSTEM for climate change adaptation in Vanuatu</p> <p>Make your livestock farms sustainable and weather-proof! From its 'composting' or 'deep litter system', this farm management practice utilizes litter materials to manage animal wastes in your farms to reduce smell and prevent pollution to land and water. This system supports sustainable integrated crop and livestock farming through the production of compost materials that can be used in fertilizing gardens for crops, plants and trees which helps adaptation to climate change.</p> <p>Collect dry litter from your house surrounding or nearby villages and establishments.</p> <p>Cover: Rearing of some pens with a base of dry litter. A good layer will be about 6-8 inches deep.</p> <p>Livestock (cows and the farmer) stand on the litter and it prevents from pig, chicken and duck pens which is ready for use in the garden.</p> <p>Materials needed:</p> <ul style="list-style-type: none"> • Bucket or wheel barrow • Dry litter • Animal urine and manure from pens • Shovel • Open area for drying <p>Dry litter materials for</p>

Appendix V: Traditional cropping calendars

A major output from this Agro-Meteorology Summit was the completion of traditional cropping calendars from each province. Much climate adaptation appropriate in Vanuatu is dependent on seasonality. For example, certain farming practices can only be applied during harvest periods, or during dry or wet seasons. Thus in order to refine the advice given to farmers, and to be able to better predict the impacts of climate variability on land based sectors, a series of cropping calendars was developed. These calendars gives a clear indication of the time of year that particular activities and climate indicators take place.

While these calendars have been developed initially at the provincial level, it is widely acknowledged that each island, and in some cases sub islands should have their own cropping calendar. These calendars may be useful as a template which agencies and stakeholders may use to further collect location specific information.

Tafea Seasonal Calendar

	January	February	March	April	May	June	July	August	September	October	November	December
Climate												
Rainfall	240mm	220mm	340mm	150mm	98mm	90mm	50mm	60mm	20mm	10mm	105mm	100mm
Temperature	26.2	26.4	26.2	25.1	23.5	22.5	21.4	21.3	21.8	22.9	24.3	25.4
Full Moon	12	10	12	10	10	9	8	7	5	5	3	3
New Moon	27	26	27	26	25	23	23	21	19	19	18	17
Tide High	1.6m	1.56m	1.47m	1.51m	1.5m	1.5m	1.51m	1.51m	1.49m	1.51m	1.54m	1.59m
Tide Low	0.11m	0.19m	0.45m	0.35m	0.05m	0.05m	0.04m	0.14m	0.27m	0.29m	0.24m	0.17m
hot season (Nov- April)												
wet season (Nov- April)												
cyclone season (Nov-April)												
cold season (May-October)												
dry season (May - October)												
Activities												
harvest of breadfruit												
tree-planting season												
harvest of namambe												
harvest of nantau (Jan-Feb)												
weeding of gardens												
harvest of nakavika												
yams are ready to harvest												
planting of citrus												
good collection of chicken eggs												
best fishing for flying fish												
harvest of citrus (orange/mandarine)												
harvest of sugarcane												
harvest of nakatambol												
offerings of best yams and fruits												
harvest of taro												
planting of taro												
hunting for wild animals												
large yam harvest												
custom harvest ceremonies												
planting of taomato												
planting of cabbage												
find places to make new gardens												
brushing and cleaning of new gardens												
trees losing their leaves (natavoa, napanga, bluewota)												
ploughing of the soil												
yam mounding and planting												
planting of kumala												
planting of water taro												

stalking of yam vines												
planting of yams												
planting of banana												
planting of manioc												
burning of gardens												
harvest of sandalwood												
harvest of mango												
harvest of banana												
harvest of manioc												
people seek food in old gardens												
harvest of mango												
christmas preparations												
Indicators												
heavy rains												
cyclones may impact communities												
NorthEast tradewinds												
breeding/mating of animals and plants												
sea birds are laying eggs												
winds may change direction												
sea temperature is hot												
the sea may be calm or rough												
NorthEast tradewinds												
cloudy periods												
plants and weeds grow substantially												
brown and green seaweed common on reefs												
wind direction variable												
sunny weather												
mango trees begin to bear fruit												
West tradewinds												
it is dry												
North tradewinds												
it is cold at night												
SouthWest tradewind												
animals get thin (pigs, cows, chickens and birds)												
trees gaining new leaves (Natavoa, Napanga, Bluewota)												
yam leaves cover poles and beds												
food is in short supply												
flowering of nantau												
flowering of nakavika												
animals moving towards the bush												
yellow hornets build nests in homes												
flowering of namambe												
wind changes direction, blowing to the North East												
the sea becomes rough												

SHEFA Seasonal Calendar

	January	February	March	April	May	June	July	August	September	October	November	December
Traditional Name	Atumorok	Atumorok	Pautango	Petemasur	Tarasarasa	Tavakavak	Viniumarik	Viniumarik	Madulele	Leasusoro	PiliRiki	PiliRiki
Climate												
Rainfall	270	278	305	232	152	132	98	68	72	102	150	175
Temperature	26.8	27	26.7	25.6	24.4	23.5	22.6	22.6	23.2	24.1	25.1	26
Full Moon	12	10	12	10	10	9	8	7	5	5	3	3
New Moon	27	26	27	26	25	23	23	21	19	19	18	17
Tide High	1.6m	1.56m	1.47m	1.51m	1.5m	1.5m	1.51m	1.51m	1.49m	1.51m	1.54m	1.59m
Tide Low	0.11m	0.19m	0.43m	0.33m	0.05m	0.05m	0.04m	0.14m	0.27m	0.29m	0.24m	0.17m
hot season (Nov- April)												
wet season (Nov- April)												
cyclone season (Nov-April)												
cold season (May-October)												
dry season (May - October)												
Activities												
Sowing of vegetable seeds												
Harvest of Namambe												
New Yam Festival ceremony												
sowing of tomato and cabbage seeds												
harvest of yams (April-July)												
Yams in growing stages (Oct-Jan)												
chiefly ordinations use yams												
best time to plant wailu yam												
best harvesting of nawita octopus												
harvest of sweet wovile (May-Sept)												
brush and burn the new gardens												
cleaning/burning of new gardens (June-Aug)												
Time to burn the roots of the big trees that are still in the gardens, the wood is the driest												
prepare gardens for planting												
Plant the first yams in the garden-These yams are for the new yam festival only												
planting of yams (Aug-Sept)												
harvest of wovile yams (Aug-Sept)												
Make fences around the gardens (so that pigs don't start to eat the yams)												
best time for planting bananas												
Indicators												
The seas are very calm												
Lots of rain, but also sun												
It is very hot												
Yams are growing strong												
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												
It is raining but stops regularly												
Yams are mature, their ropes/vines are dry												

The weather is sunny and begins to be dry													
The mackerel/sardines are many along the shore													
The breadfruits begin to ripen													
Sweet Wovile (wild yam)- when it is dry, and windy, hill fires burn so the yam is ready to dig and eat													
Noise of dryness, walking through the bush leaves													
soil is very dry													
yam leaves are dry and fall off the plants													
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													
flowering of narara (June-Aug)													
yam gardens are old now													
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													
it is very cold during the night													
Wind is very strong; Rustu (SE) winds													
whales come to the bays													
When the full moon comes out, any droughts will be reversed													
It is time for sleeping, working is finished, the yam is resting													
breadfruit produce rubber-like flowers													
Butterflies come out everywhere and many colors, this indicates the yams are growing (and the planted yam is now dead, new shoots growing)													
Turtles are coming ashore to lay eggs (nesting season)													
The yams have started producing vines/ropes													
palolo worms come out of the reefs													
"you sareme eye smol taem be i daylight" - day long night short													
There is brown foam floating on the surface of the sea (called the urine of the stonefish)													
The sea is not very clear (dirty)													
The sea is hot in some places and cold in others													
the nights are long "sareme eye longfala taem"													
Fish are making eggs (Black piko) and they make schools of fish and travel together													
yellow mangrove flowers													
Angawa- "thinking of planning and doing something, but can't do it"													
breadfruit harvest (Dec-Feb)													
The sea goes above the normal high tide													

PENAMA Seasonal Calendar

	January	February	March	April	May	June	July	August	September	October	November	December
Traditional Name	SiroSiro	Maragaba	Udurara	Udelawua	Udematala	Udegamad	Udututunu	Loha	Vuleqaravu	Taranwevu	Tanlawua	Gulume
Traditional Seasons		Makoto			Rara			Undu			Walahi	
Climate												
Rainfall												
Temperature												
Full Moon	12	10	12	10	10	9	8	7	5	5	5	5
New Moon	27	26	27	26	25	23	23	21	19	19	18	17
Tide High	1.6m	1.56m	1.47m	1.51m	1.5m	1.5m	1.51m	1.51m	1.49m	1.51m	1.54m	1.59m
Tide Low	0.11m	0.19m	0.45m	0.35m	0.05m	0.05m	0.04m	0.14m	0.27m	0.29m	0.24m	0.17m
hot season (Nov- April)												
wet season (Nov- April)												
cyclone season (Nov-April)												
cold season (May-October)												
dry season (May - October)												
Activities												
Planting Kumala (march)												
harvesting Kumala (July)												
brushing and cleaning of taro gardens (May-June)												
planting of taro (July)												
harvest of taro (March - June)												
brushing and cleaning of new yam gardens (July)												
harvesting of yam (May-July)												
planting of yams (August - Sept)												
flowering of cacao (Jan)												
harvesting of cacao (May)												
flowering of mango (Oct)												
fruiting of mango (Dec-Jan)												
planting of tomato (July - Sept)												
harvesting of tomato (Sept- Nov)												
Nantao + Naos (flowering) (March)												
Nantao + Naos fruiting (May-June)												
Nakavika flower and fruit (September)												
Nangai fruiting (green to black) (Sept - Nov)												
Namambe flowering (March)												
Namambe harvest (May-June)												
flowering of oranges/citrus (Feb-May)												
harvesting of oranges/citrus (May-July)												
good fishing - the sea is quiet (June - July)												
fishing season is winding down (August)												
prepare kava gardens (July-August)												

planting of kava gardens (Sept-dec)												
breadfruit is ready (3x per year: March, July, December)												
prepare rotten breadfruit in cave for cyclone food (mara)												
begin the collection of pololo worms (March) udu rara												
Pololo worms are large and fat (April) udu lawua												
Indicators												
biggest rains (feb - March)												
wild birds are fat and meaty (May - June)												
flowering of narara (June-July) - time to plant Taro												
many flies (indicate readiness of mango and breadfruit)												
days are long (sept-april)												
days are short (may-August)												
flowering of the wild tree (paranume- yellow flower) indicates time of the flying fox												
north winds (may-july)												
little wind, and much rain (jan-april)												
time to check on old gardens to see what food is left												
keep fires lighted because most of the firewood is wet												
when the wind blows, light your fire at the very end of garden so it burns across, and right to the ground												
a dark cloud appears and takes in all the other clouds- long dry season approaching												
noise in the NW, and pigs begin to dig around the soil (kanduehurihuruveue)												
chickens walk on ground all night, cyclone will hit next day												
when you try and plant with a wooden stick it will be rotten and break to pieces (May) - udu matala												
garden is dry and easy to burn (loha)												
time for roasting root crops - tutuna												
time of cold weather - gama didi												
not a good time for work because of wind and rains - gulume												
things are sprouting well and quickly from the soil - tan lawua												
lots of food around and people can share if asked - taranweuweu												
longest days - vuleqaravu												
Walaihi- tree with red leaves, fruits are ready (e.g. banana)												
Rara- bananas are in large bundles												
Makoto (type of grass) - all the fruits in the garden are large -taro, naviso-sugarcane, nawita												
undu- springing and shooting of plants												

MALAMPA 2013 Seasonal Calendar

	January	February	March	April	May	June	July	August	September	October	November	December
Climate												
Rainfall	260mm	245mm	275mm	225mm	160mm	140mm	120mm	130mm	135mm	140mm	135mm	145mm
Temperature	27.1C	27.3C	27.2C	26.6C	25.8C	25.1C	24.5C	24.4C	24.9C	25.4C	26.2C	26.8C
Full Moon	12	10	12	10	10	9	8	7	5	5	3	3
New Moon	27	26	27	26	25	23	23	21	19	19	18	17
Tide High	1.6m	1.56m	1.47m	1.51m	1.5m	1.5m	1.51m	1.51m	1.49m	1.51m	1.54m	1.59m
Tide Low	0.11m	0.19m	0.45m	0.35m	0.05m	0.05m	0.04m	0.14m	0.27m	0.29m	0.24m	0.17m
hot season (Nov- April)												
wet season (Nov- April)												
cyclone season (Nov-April)												
cold season (May-October)												
dry season (May - October)												
Activities												
beginning of the fishing season (Nov- March)												
harvesting of fruits and nuts (Nov-march)												
weeding of yam gardens (Oct-March)												
planting of bananas (Dec- March)												
begin harvest of yam (March)												
brush gardens (April- August)												
plant vegetables and root crops (April - June)												
dig and harvest of yams (April- August)												
tunafish may be caught (April-June)												
harvest of Cocoa (April-June)												
many tunafish are caught (May-June)												
many octopus are caught (May-June)												
Plant watermelon (July-August)												
end of yam harvest (Oct)												
yam gardens are burned (June-Aug)												
nepef/nubut (disaster food) is ready (May-July)												
ongoing planting of water taro												
planting of island taro (July-Sept)												
plant kumala (April-Aug)												
plant kava (Nov-April)												
fishing season (especially for Rabbitfish/Piko) (Sept-Nov)												
milking of the wild yam (Sept -Nov)												
ropes/vines of the yams come up (Sept-Nov)												
replanting of yams (July-Sept)												
harvesting of nuts (May-Nov)												
harvest of mangos (Nov-Jan)												

Indicators												
flowering or fruit trees (Nov-March)												
crabs and other marine resources are fat (Nov - March)												
animals are breeding												
NorthEast winds (Nov-March)												
feels very hot (Nov- March)												
rains a lot (Nov- March)												
flying foxes seek fruits												
the sea is rough												
cyclones may impact communities												
black crabs come out												
many flies												
many jellyfish in the sea												
flies change into rabbit (pico) fish												
fish are fat and have eggs												
leaves are falling off the trees (April- August)												
it feels very cold (April - August)												
SouthEast winds (April- August)												
Benbow erupts (??) (April-August)												
Naviso flowers (April-August)												
patures do not grow well (April-August)												
Mango flowers (August-Sept)												
Narara flowers (August)												
days are long (May-June)												
the ropes/vines of the yams are very dry (April-Aug)												
wildcane flowers												
many Palolo worms on the reefs (Sept-November)												
many flies (Sept-Nov)												
Nakavika trees flower (May & Nov)												
Namambe flowers (Sept-Nov)												
Mango flowers (Sept-Nov)												
nights are very dark												
taro shoots emerge (Sept-Oct)												
palolo worms are short												
palolo worms are large												

SANMA Seasonal Calendar

	January	February	March	April	May	June	July	August	September	October	November	December
Traditional Name												
Traditional Seasons	Bong Cinaha			Bong Mahariri	Dam Maluni		Bong rara Hulua		Bong Dulea		Bong Langilosu	
Climate												
Rainfall	335	325	295	290	248	190	125	110	125	175	195	210
Temperature	26.5	26.6	26.5	26.2	25.4	24.8	24.3	24.1	24.5	25.1	25.9	26.2
Full Moon	12	10	12	10	10	9	8	7	5	5	3	3
New Moon	27	26	27	26	25	23	23	21	19	19	18	17
Tide High	1.6m	1.56m	1.47m	1.51m	1.5m	1.5m	1.51m	1.51m	1.49m	1.51m	1.54m	1.59m
Tide Low	0.11m	0.19m	0.45m	0.35m	0.05m	0.05m	0.04m	0.14m	0.27m	0.29m	0.24m	0.17m
hot season (Nov- April)												
wet season (Nov- April)												
cyclone season (Nov-April)												
cold season (May-October)												
dry season (May - October)												
Activities												
planting of dryland taro												
harvesting of dryland and water taro												
time for conservation of birds												
no garden work, lots of hunting												
planting of sweet potato												
harvest of new yams												
harvest of naos												
preparation of vegetable seed beds												
Good time for planting of kumala, taro, yam, as it is dry and does not encourage too much leaf growth												
Planting of vegetables like English cabbage/tomato												
Time of preparing new gardens for yam												
Burning of gardens (july and august)												
Planting of kumala, taro, yam												
Harvest of nakavika, nantao, nangai, namambe												
Hunting for fish is successful												
Planting of new yam												
building of hurricane proof houses												
good hunting time												
Breadfruit and Mangoes are ready for harvest (Dec)												
Food preservation for cyclones (digging holes for yam, manioc, and banana)												
Indicators												

Lots of fruit available and colorful trees												
Birds like nawima, natarua, nasiviru lay eggs (march)												
short day												
bonito begin to run along the shoreline												
mankura fish swim in schools along shore												
yam leaves are dry and may be harvested												
eg laying of nawimba												
the sea is quiet												
Flowering of Narara- leaves are dry												
People's lips are dry and cracked, cuts and sores are painful and do not easily heal (july)												
Flying foxes are plentiful (july)												
Bluewater makes new leaves (august)												
sea is rough												
Bluewater tree flowers (Sept)												
crabs, fish, naura, pijin, coconut crab are with eggs and fat for harvest												
Flowering of Mango (September)												
Turtles Laying Eggs (Oct-Nov)												
flowering of orchids (jan)												
flowering of nakavka												
food is not plentiful												
Turtles hatching (Nov-Dec)												

Appendix VI: Summit Discussions, Questions and Resolutions

Topic: What is Agro-meteorology?

Agriculture and meteorology are two compatible and significant sectors and are not simply two parallel lines of activity. Previously, farmers would only focus on how best they can maximize their production without much thought to the existing climatic conditions. However with the extra challenge posed by climatic changes, farmers now need guidance in meeting such tests. This is where the input of meteorology to provide directions into agriculture activities is vital.

Agro meteorology therefore deals with:

- Water – rain, including raindrop formation, patterns and processes
- Heat – radiation and what happens to it
- Air – in the atmosphere and its movement
- Related biomass development

Additional Aspects of Agro-Meteorology

Agro-meteorology contributes in various ways to community life and livelihoods particularly through mechanisms in which it addresses climatic change challenges such as;

- Social and economic aspect of the production environment
- Relocation of communities; e.g. in instances where flooding or landslides impact on vulnerable communities
- Sharing/barter; occurs where other communities assist others which are affected by extremities such as during drought times
- Improved social cohesion
- Easier to access/intro new ideas
- Target audience/captive audience
- Entry point for other interventions

Economic

- Enhances global concerns/intervention e.g. through the involvement of donor partners
- Confidence to deal with extremes
- Demand for food /supply opportunities

Information flow schemes (2)

- Agro-meteorological services in the livelihood of farmers
 - Agro-meteorological advisories and services
 - Agro-met bulletin/news
- Scientific support system (data, research, education/training) to enable farmers to better understand the conditions affecting their production
 - Crop field observation
 - Soil (moisture) observation
 - Routine meteorological observation

Agro - meteorological services

- In developing countries, few existing systematic reviews of farmers needs for weather services and related climate information
- In-service training on climate products and advisories on adaptation to impacts

Agro-met- what to do, what is possible and what is necessary

- Specific agro-met forecast; agriculture sector to indicate what type of information is needed from meteorology
- Early warning system (El Nino and La Nina) i.e. how to set up such systems
- Revisit and facilitate Traditional practice (good practices)
- Climate field schools
 - Starting of seasons (planting times)
- Web base tools, may not be viable in Vanuatu
- Improved designs for environmental protection

- Cropping calendars

How to improve Agro-met in the Pacific

- Better and more strategic use of climate information
 - Responding to and decreasing risk from disaster (build capacity of farmers as decision makers on potential climate and climate change related hazard reduction)
- Coping with climate variability and climate change
 - Specific crop models to use with climate models
 - Improving the issuing, absorption and use of climate forecast information in agriculture production
- Coping with extreme with extreme meteorological events
 - Problems and solution in coping with extreme climate events (research/science to contribute to solution)
 - Designing and select early warning strategies
- Tactical decision making based on weather-information
 - Designing and selecting weather related tactical application for agricultural management and increase their efficiency

Plenary/discussion points

- Many agriculture field officers are still not using meteorology products or variables in their daily work e.g. temp or rainfall (despite the fact that many have already attended 2 national agro-meteorology summits.) Other sectors such as maritime are actively using the info from meteorology sector. Therefore the need for agriculture officers to actively seek information/advice from climate section of VMGD seeing as it will be the avenue by which farmers are convinced in using climate products.
- VMGD puts out a range of products which are there for the public to use. Currently sectors such as maritime industry, construction industry and aviation are actively using these products.

The agriculture sector must do the same otherwise time and resources are wasted in producing such information (e.g. seasonal outlook, monthly updates, 7 day forecasts). Need to revisit and strengthen current MOA between DARD, VMGD and GIZ.

- Agriculture officers, especially extension officers, are encouraged to source information given that information which is new can attract or catch the attention of farmers as well as market agricultural stakeholders. Farmers in particular, where information is not updated, risk holding onto unproductive and/or climate sensitive traditional practices. DARD officers must find ways of ensuring information can be readily disseminated e.g. having leaflets always in hand that can be distributed to farmers.

- ***The Agriculture department suggested the possibility to allow for climate information to be disseminated using SMS via mobile phone networks hence the Ministry of Climate Change should demand that our telecommunications companies incorporate agro-met information into their existing line of services.*** Current information sharing channels such as radio talk back shows with farmers are not working effectively. VMGD at the moment is developing something along the lines of using a SMS product though it is yet at early stages of development.

- Productive sectors should also be made aware of existing information sharing services and maximize their use. Radio Vanuatu has regular donor funded programs (every Tuesday and Thursday) by which the productive sector can obtain agrometeorology information however currently only the Livestock Department and Biosecurity Vanuatu are making use of these avenues to pass information

- Concern was raised as to areas or locations where mobile phone network or communications coverage is limited. VMGD is now working to establish bulletin boards in provincial council premises where meteorological information or products can be displayed.

- How the farmer can interpret climate related information given, and how to go about making use of the information is still a barrier. Restructuring the agriculture department to support provincial based officers can allow for much needed assistance to the farmers to make the right analysis and undertake appropriate actions from agro-meteorological information received

- Use of technical language needs to be considered carefully, and it is preferred that officers from the department of agriculture are aware of what is happening in other departments. For example sometimes a farmer makes a query to a visiting officer who is unable to provide information from other sectors. Information sharing in regards to what is happening in different department within agriculture/productive sector is vital.
- There are existing governance structures by which climate and agromet information may be channeled (e.g. the present Technical Advisory Committee (TAC) network in provincial areas. The Department of Local Authorities is now working to reestablish and further empower area councils.

It was recalled that from the Santo 2012 agromet summit, a list of contacts (focal points) for the purposes of agromet networking was compiled to assist with the dissemination of information to farmers. However the question remains as to whether such focal points are functional and the agromet information is being utilized.

- The question was raised relative to whether there has been any development to date in the field of crop modeling or are there any crop production models (e.g. for yam, manioc, etc) by which the agriculture department is currently using. Such a model can be integrated with climate models so that specific productivity projections can be made for a given future climate. Whilst Vanuatu's DARD is not yet using any crop production models, this is a high priority research opportunity for potential students or researchers. (Note: SPC is currently working on some models but these have yet to be finalized). SPREP on its part does not look specifically into this area however if the agriculture sector sees that it is an agrometeorological priority then a concept paper can be developed and funding be sought. The NARI project may support crop modeling; this issue will be raised in the next NARI project team's visit to the country.
- In order to advance the potential usefulness of crop modeling there is need to expand the climate observations network as it currently only gathers basic weather information. Crop modeling will require observations on for parameters such as soil temperature, humidity, and evaporation etc.

- Current internet and communication networks need to be improved or strengthened to better enable access to agro-meteorological information; at the moment officers based in the provinces have to travel long distances to use or access the e-government system.

Modern or science based agrometeorology information may clash with long held traditional beliefs with regards to changes in climate and agricultural practices. In order to minimize ideological clashes, existing information sharing networks and individuals should be used to pass agro-met information. Also attempts should be made to integrate traditional knowledge and meteorological information in existing projects to ensure community comprehension and support.

- The existing MOA between VMGD, GIZ and DARD should be revisited. Whilst a lot of work is currently being there are still some clarity issues and shortfalls namely in terms of coordination and how activities can be carried out among the three partners. Furthermore, in distributing information to farmers there are two (2) challenges; firstly how information is to be conveyed and the likelihood that climate projections passed on to farmers will occur.
- It was suggested that an agro-met office be formed and should include the active involvement of agriculture officers. VMGD has already identified within its' structure an officer with such responsibilities but this should be complemented by institutional arrangements within DARD.
- Technical information on climate change, weather and climate variability can be difficult to simplify. Previously, agromet informational bulletins contained up to 5 pages of information. With much effort to simplify the information, the Climate Section of VMGD have now condensed all this information to approximately one page in Bislama. It is however vital that farmers determine what information is contained within the bulletins and make recommendations on the level of technical detail required.
- Given that there are different customs and traditions within our islands, it was suggested that for the next agro-met summit, custom representatives from each island be invited to participate since the elements of culture, meteorology and agriculture need to be work closely integrated.

- From the experience of the Whitegrass synoptic station officer, most farmers in Tanna have never seen the current agrimetbulletins (e.g. monthly outlooks) that are produced by Vila VMGD staff. Thus the proposition was made that agrometeorologyinformation can also be channeled through the seven (7) synoptic stations around the country.
- In addition to the passive dissemination of agrometeorology information, it was suggested that response practices be piloted or trialed so that famers can see tangible results from following agrimet advice. Theoretical or academic informationwill not likely convince farmers to take up new practices.
- It was reiterated that strengthening information sharing and access to farmers should be done through area council networks
- . It was further emphasized that whatever agrometeorologyideas being discussed must to be trialed. Farmers are also scientists who trial out methodologies and practices and take future decisions based on results obtained. Thus agrometeorology-guided productivity practices must be proven before being disseminated in order for farmers to gain trust in new technologies, information and approaches.
- The suggestion was made by DARD (Director) that all field officers need to have their own garden plots to demonstrate agrometerology advice, practices and outputs so that people/farmers have tangible results that they can to relate to.

Topic : Building Community Resilience through Weather and Climate Information

Background

The Secretariat of the Pacific Regional Environment Programme (SPREP), through its' Pacific Meteorological Desk Partnership, assists Met services throughout the Pacific to effectively deliver their services down to the community level. A major area of work relates to climate information. Much of this

work by SPREP is guided by the Pacific Islands Meteorological Strategy. The strategy strives to link other DRR and climate change regional strategies, and outlines how met services can contribute in assisting sectors translate strategic directions into tangible actions at the community level.

Global Framework for Climate Services (GFCS)

At the international level, the Global Framework for Climate Services (GFCS) provides guidance to all meteorological services around the world so that met services can assist different sectors and communities. Through the GFCS there is opportunity for national level support in several key areas related to climate change and climate services.

Climate Change and Climate Services

- All Communities experience Climate variability and Climate extremes; however it is most common for communities to talk about how climate change is affecting their crops, despite the fact that climate variability and extremes may most affect productivity.
- Seasonal Forecasting is an important tool to inform communities about and enable them to undertake short term adaptation actions and long-term adaptation processes
- Using traditional knowledge as a vehicle to deliver agrometeorological information may be appropriate in Vanuatu; particularly given the introduction of new science concepts which communities find difficult to accept. Harmonising new agrometeorological concepts with traditional knowledge is vital.

Concerns

- There are multiple climatic factors which impact on our daily lives in Vanuatu and the Pacific. Some areas of the world may be more severely impacted by climate extremes and variability (e.g. sub-Saharan Africa) where in times of drought hardly any food can grow or diseases caused by flooding events cause mass human mortality.
- There are differing levels of infrastructural capacities within meteorological institutions around the world. A 2010 global survey showed that met services fall within a range of capacities in their ability to provide basic, essential, full and advanced climate services. Vanuatu is classed as being able to provide essential services.

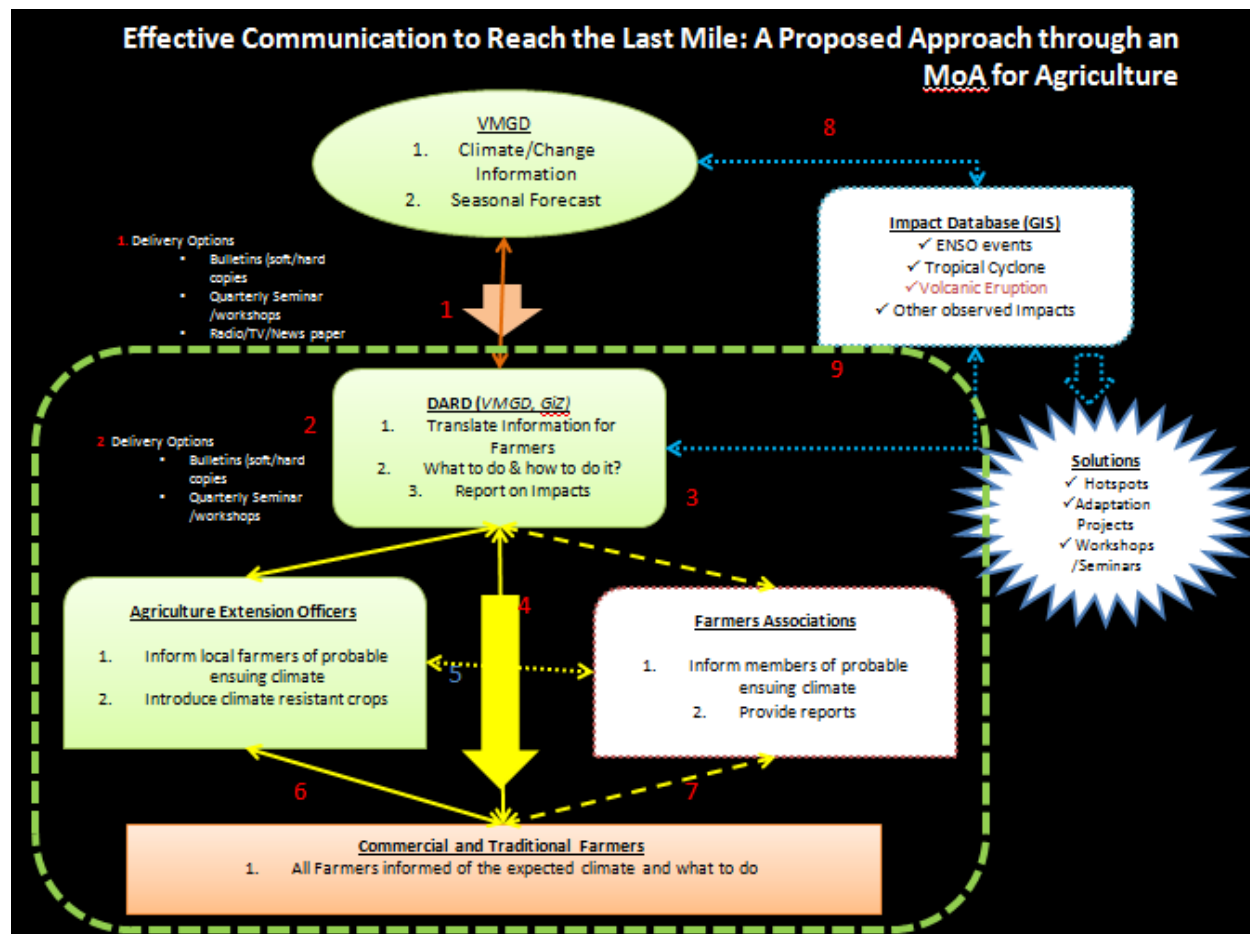
- A lot of data and services are being generated but do not then translate into climate products and information that reach the “last mile” i.e. the community member, in a format that is easily understood or accessible.

Challenges

- Information access by rural vs. urban communities; often VMGD produces information which suits the context of residents in Port Vila and not those living in the rural areas
- Literacy Levels and gender issues constrain the transmission of information to key stakeholders
- Communication/Isolation is a major concern in many communities and islands in Vanuatu
- The many different Languages spoken in Vanuatu may limit the usefulness of information disseminated in the official languages of French, English and Bislama.
- Different cultural backgrounds throughout the country preclude the use of single standard information dissemination formats
-

Effective Dissemination

- A Climate Communication Strategy produced by VMGD in 2012 has an overall goal of reach the last mile
 - o Effective communication may require providing Catalyst/incentives/mechanisms to ensure information reach the last mile
- Some potential catalysts:
 - o Binding MoAs, Revised job descriptions JD's, National Policies and agency Plans such as Business Plans & Corporate Plans, training etc
- Communication within sector agencies is currently working well although access to information by community level stakeholders and management of data (e.g. ENSO impacts data) are still outstanding issues.
- Proposed approach (refer to Fig below)



Proposed approach for effective information delivery

Appendix VII: Output 1: Participants Place Stories and Memories on Vanuatu ENSO timeline

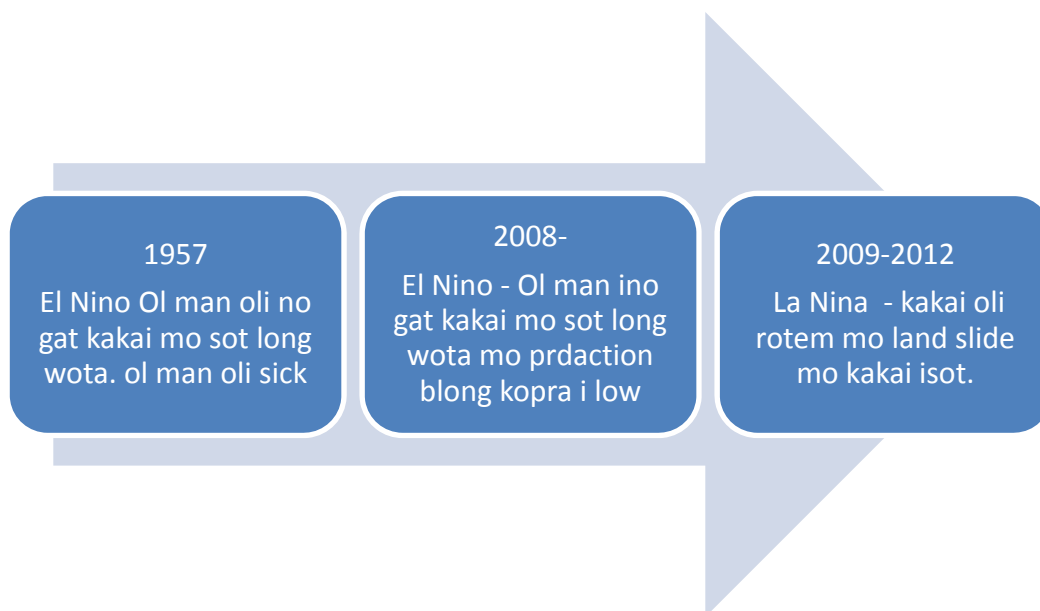
TORBA PROVINCE

La Nina

Name of province	Island facing problems (El Nino)	Village/area name	Year	Impacts faced	What did people do in order to survive or cope?
Torba	Vanualava Motalava	Vanualava Motalava Merelava Mota	2009-2012	<ul style="list-style-type: none"> Olkakai long karemolsem manioc yam taro oliroten Land slide Ol grass blongol bullock olided Fullaprabis grass oli grow olbaot 	<ul style="list-style-type: none"> Olikakai wild yam Olisevemolhan blong manioc island cabbage taro etc long sefoles we ino gat tumaswota long hem.

El Nino

Name of province	Island facing problems (La Nina)	Village/area name	Year	Impacts faced	What did people do in order to survive or cope?
	Motalava	Matanla	1957	<ul style="list-style-type: none"> Coconut wetemol fruit inomo gat Wota long riva l dry Ol man olisitsitwota. 	<ul style="list-style-type: none"> Karemwota long vanualava Kakai dry bred fruit Kakai thatch Kakairorot tuba (laplap) Drink wota long rop
	Ureparapara	Lehali	2008	<ul style="list-style-type: none"> Olkakaiolsemanana,manioc,taro olinogud Coconut fruit oli hang strong oli no save foldaon Olimekemkopra Wotaolidrae long krek <ul style="list-style-type: none"> Mo ol swam oli dry 	<ul style="list-style-type: none"> Olikakai wild yam Kakai dry coconut and fish



SANMA PROVINCE

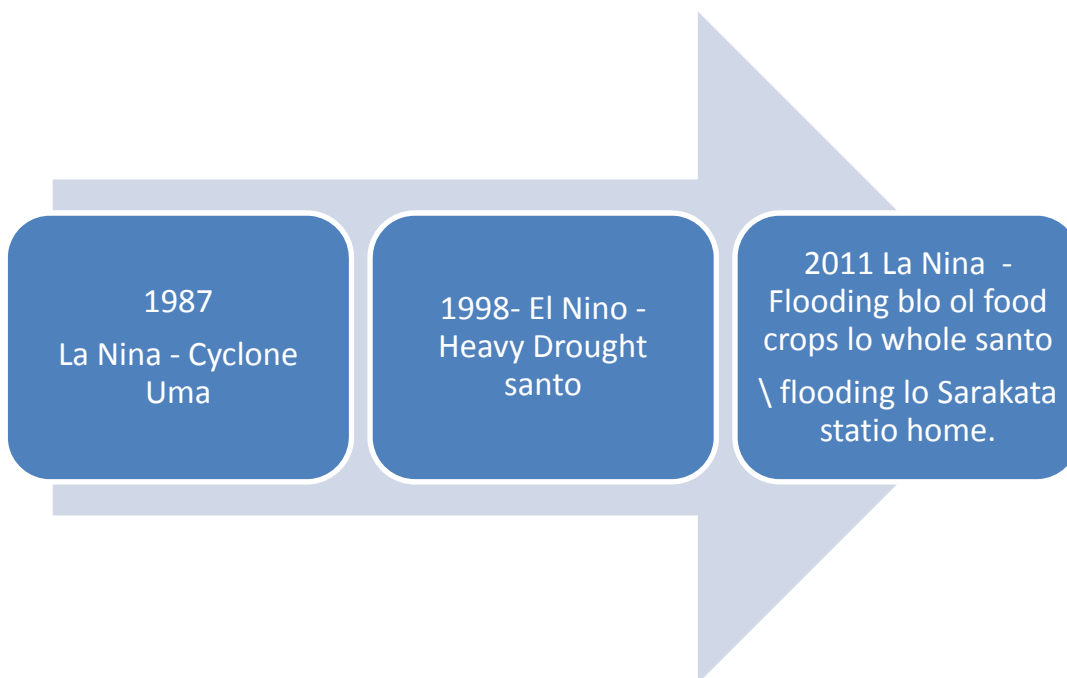
La Nina

Name of province	Island facing problems (El Nino)	Village/are a name	Year	Impacts faced	What did people do in order to survive or cope?
Sanma	Santo	Full sanma	1987 Cyclone Uma	<ul style="list-style-type: none"> River damaged Bridges 	<ul style="list-style-type: none"> Government I givimrais motapolen No Home
sanma	Santo	South santo	2011	<ul style="list-style-type: none"> Heavi rain I pulumol taro Heaviren I brokembrigde 	<ul style="list-style-type: none"> Pulumaotkakaikosop long riva Digimnara rod long saedblongriva
	Santo	sarakata	2011	<ul style="list-style-type: none"> Heavi rain I spolemgudhaosblongol man 	<ul style="list-style-type: none"> Evacuation Buildemolhaosantap
	Santo	Showground	2011	<ul style="list-style-type: none"> Ol yam oli no givimgudkakai 	<ul style="list-style-type: none"> Pem long agriculture Good storage to plant again
	Santo	champuis	2011	<ul style="list-style-type: none"> Seeds blong wait wood I gat wasp Yam inomekemgudkakai from fungus moo I narafalasikbebet 	<ul style="list-style-type: none"> Use other wildings from other plantations Good storage Early harvest Brashemgudoltipersm

					osterm • Yam vines cutting
--	--	--	--	--	-------------------------------

El Nino

Name of province	Island facing problems (La Nina)	Village/area name	Year	Impacts faced	What did people do in order to survive or cope?
Sanma	Santo	Cattle project	1998	<ul style="list-style-type: none"> Strong sun bullock died 	<ul style="list-style-type: none"> Salem bullock long low price, 5,000vt hed
sanma	Santo	VARTC	1998	<ul style="list-style-type: none"> Ol Taro olided yang 	<ul style="list-style-type: none"> Pulumaot long field
	Santo	Chapuis	1998	<ul style="list-style-type: none"> Ol seedling olided 	<ul style="list-style-type: none"> Putum long nurseryshedmo H2o
	Santo	Forestry Nursery	1998	<ul style="list-style-type: none"> Ol kulino gat wota 	<ul style="list-style-type: none"> Oliwotaplante long ol seedling
	Santo	Matevulu	1998	<ul style="list-style-type: none"> No H2o for drink and cook 	<ul style="list-style-type: none"> Sendemaotolpikininiig o long haos
		Malo	1998		<ul style="list-style-type: none"> Collectem H2o from spring water & pump



MALAMPA PROVINCE

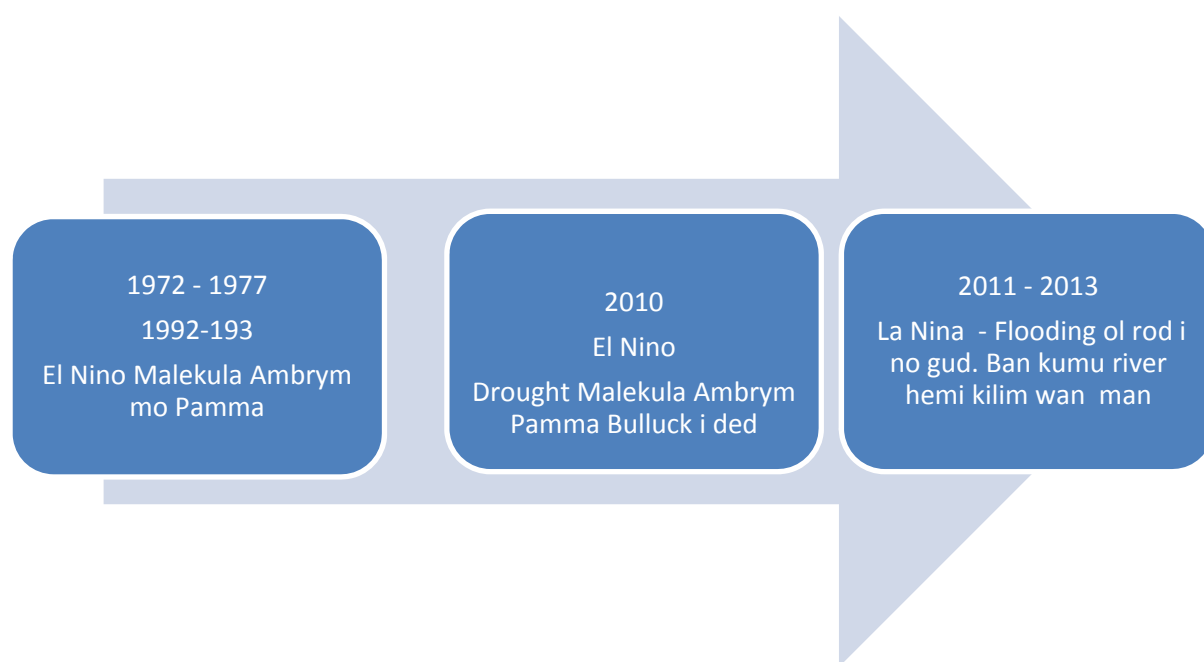
La Nina

Name of province	Island facing problems (La Nina)	Village/area name	Year	Impacts faced	What did people do in order to survive or cope?
Malampa	Malekula	Whole island	2010	<ul style="list-style-type: none"> • Ol rod blongtrak I nogud • Ol rod blong Karen olisofmat • Cash crop production affected 	<ul style="list-style-type: none"> • Oliusum boat • Oliwalkabaot • Olimekem bush rod long bush
			2011	<ul style="list-style-type: none"> • Ol rod I nogud • Ol rod blong Karen olisofmat 	<ul style="list-style-type: none"> • Oliusum boat • Oliwalkabaot • Olimekem bush rod long bush
			2013	<ul style="list-style-type: none"> • Ol rod I nogud • Ol rod blong Karen olisofmat 	<ul style="list-style-type: none"> • Oliusum boat • Oliwalkabaot • Olimekem bush rod long bush

El Nino

Name of province	Island facing problems (El Nino)	Village/area name	Year	Impacts faced	What did people do in order to survive or cope?
Malampa	Malekula.	North west	1972-1979	<ul style="list-style-type: none"> • Kakaiino gat • Water dry • Bush fire 	<ul style="list-style-type: none"> • Eat food wild povile • Eat food Nipet • Eat yang banana not ready • Make garden alongside greek
		CentalMalekula	1992-1993	<ul style="list-style-type: none"> • Shortage of food • No water dry • Bush fire 	<ul style="list-style-type: none"> • Eat food wildpovile • Eat food nipet • Eat yang banana not ready • Make garden alongside greek
	Ambrym	North/west mo SEAmbrym	1992 - 1993	<ul style="list-style-type: none"> • No food • Bush fire 	<ul style="list-style-type: none"> • Eat food wild povile • Eat food nipet • Eat yang banana not

					ready
		Uripiv	2010	<ul style="list-style-type: none"> Bullock ded Well oli dry 	<ul style="list-style-type: none"> Make garden alongside greek Eat food wild povile Eat food nipet Eat yang banana not ready Make garden alongside greek

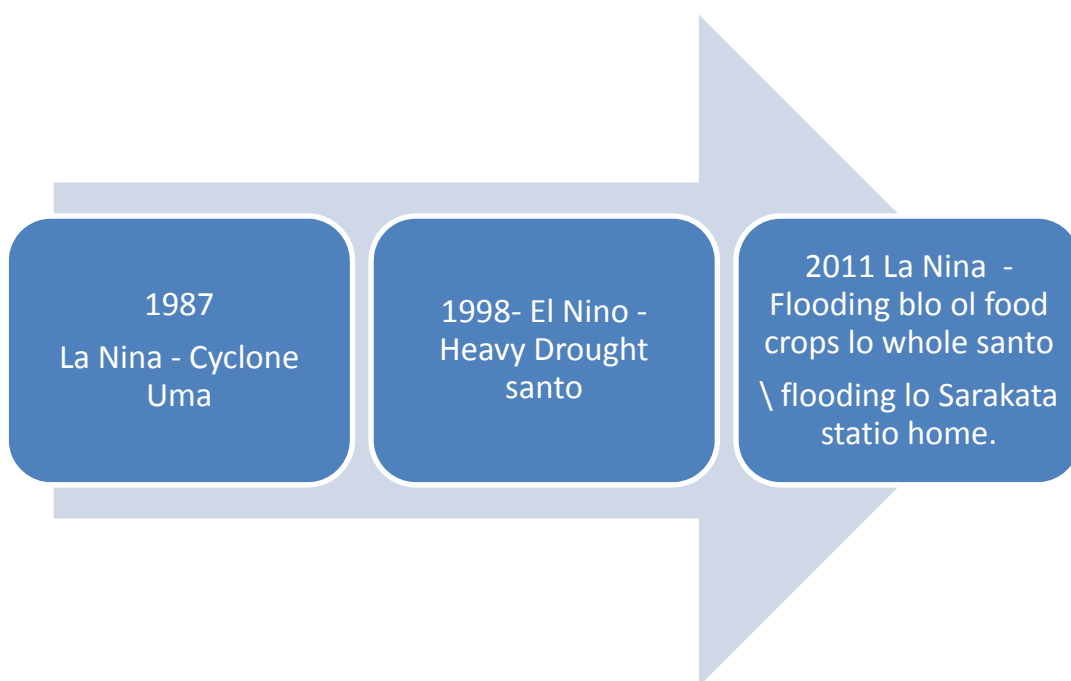


PENAMA PROVINCE

La Nina

Name of province	Island facing problems (El Nino)	Village/area name	Year	Impacts faced	What did people do in order to survive or cope?
Penama	PentcostAm bae Maewo	Central	1963	<ul style="list-style-type: none"> Water shortage Food shortage Island cabbage Taro Sickness- diahorrea 	<ul style="list-style-type: none"> Usumsolwotakukumm o swim Spingwota Drink coconut
		Whole Penama	1997	<ul style="list-style-type: none"> TB Animal olided Bulluckpifaol Bush fire ol tree grass 	<ul style="list-style-type: none"> Usumsolwota Sringwota Drink coconut Ol farmer oli mas

				olided <ul style="list-style-type: none"> • Shortage blongwota shortage blongkakai • River oli dry • Olfrshwota fish olided • Nauranamaraiwota fish olided. 	force blongsalem product blongol <ul style="list-style-type: none"> • Usum unsafe wotaeg lake waimemen • Depend plante long ol export food • Highr pressure long olkakaiolsmNavia wild yam wild popile.
	Maewo Pentecost Ambae	Kiloi river North maewo	1967 to be verified	<ul style="list-style-type: none"> • River over flooding 	<ul style="list-style-type: none"> • Depend on relief programme • Import food • Other alternative
	Ambae	North Ambae	2000 to be verified	<ul style="list-style-type: none"> • Flooding of rivers bank • Creek • Victims death • Shortage oskakai 	



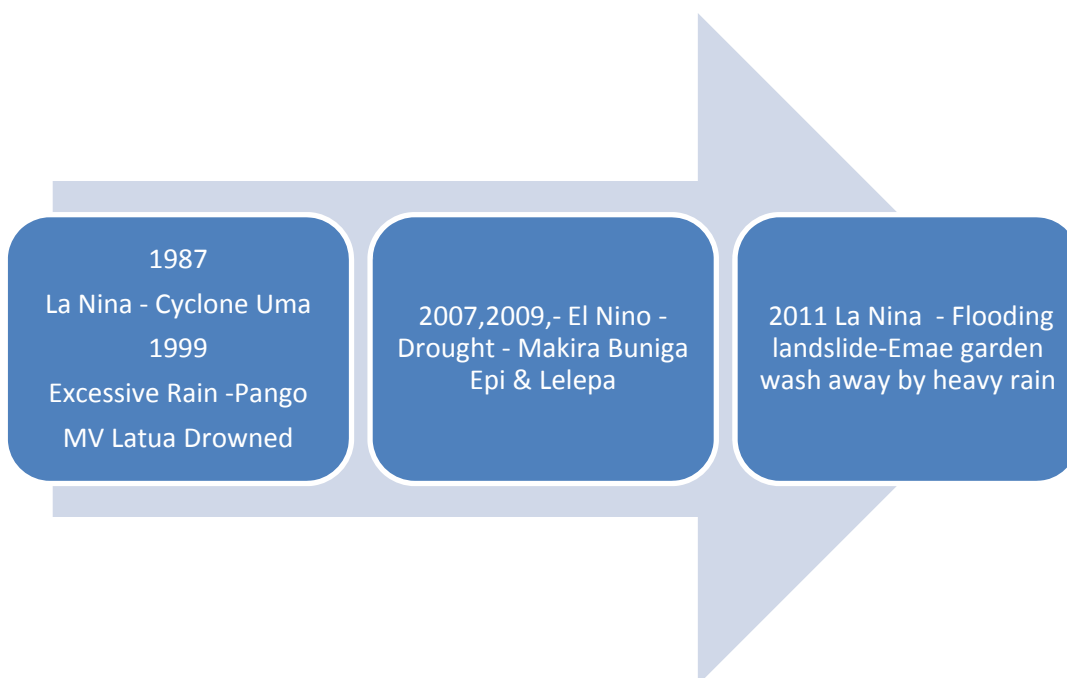
SHEFA PROVINCE

LA NINA

Name of province	Island facing problems (La Nina)	Village/area name	Year	Impacts faced	What did people do in order to survive or cope?
Shefa	Emae Mataso	Emae Mataso	1999	<ul style="list-style-type: none"> Excessive rain wind Latua Drown 	
	Efate	Pango/Mele bay	1999	<ul style="list-style-type: none"> Excessive rain wind 	
Shefa	Mataso/Em ae	Marae Vinovgge vaima	2011	<ul style="list-style-type: none"> Flooding Land slid 	<ul style="list-style-type: none"> Food security Wash DRR GOOD GOVERNMENT

EI NINO

Name of province	Island facing problems (El Nino)	Village/area name	Year	Impacts faced	What did people do in order to survive or cope?
Shefa	Mataso	Mataso	2009	<ul style="list-style-type: none"> Water shortage 	<ul style="list-style-type: none"> Water Supply by government
Shefa	Makira	Makira	2011	<ul style="list-style-type: none"> Food damage 	<ul style="list-style-type: none"> Eliminate flying fox
	Buniga	Buniga	2009	<ul style="list-style-type: none"> water shortage 	<ul style="list-style-type: none"> Government provide water shipment
	Epi	Nalema	2007	<ul style="list-style-type: none"> Dead fish 	<ul style="list-style-type: none">
	Lelepa	Lelepa	2009	<ul style="list-style-type: none"> Water shortage- school closed 	<ul style="list-style-type: none"> Government supply water



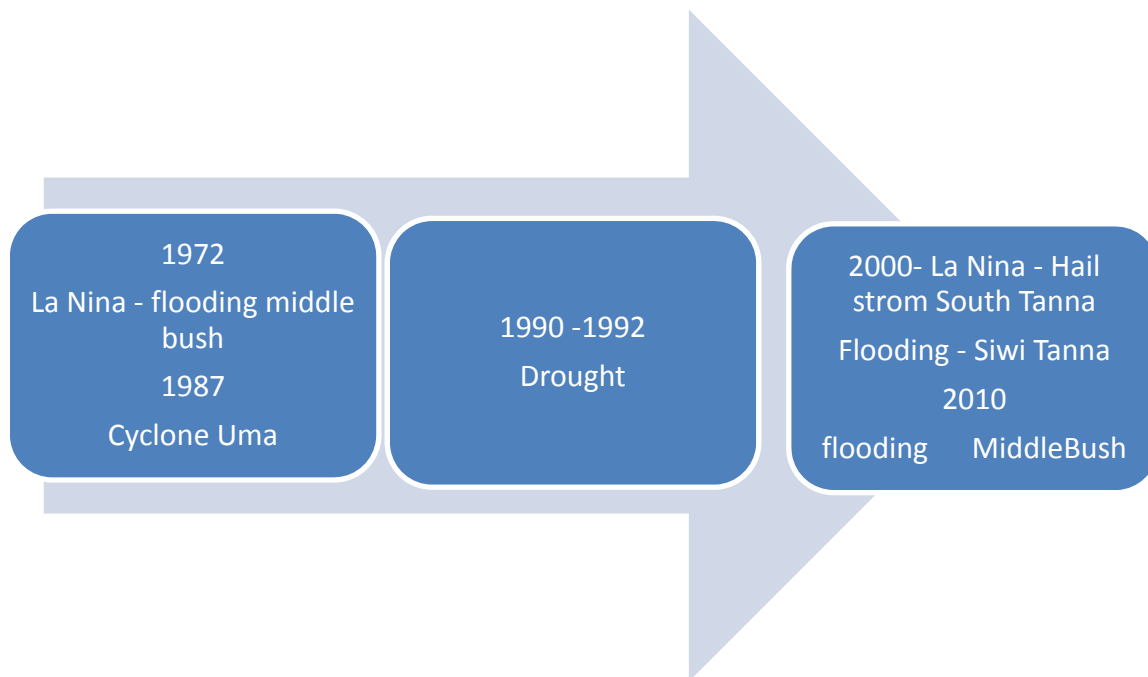
TAFEA PROVINCE

La Nina

Name of province	Island facing problems (El Nino)	Village/are a name	Year	Impacts faced	What did people do in order to survive or cope?
TAFEA	Tanna	Middle bush	1972	<ul style="list-style-type: none"> Flooding 7 days 	<ul style="list-style-type: none"> Diver from kakai
		South east	2000	<ul style="list-style-type: none"> Hailstorm 	<ul style="list-style-type: none">
		Siwi	2000	<ul style="list-style-type: none"> Road affected Landslide 	<ul style="list-style-type: none"> Relocation of people east community Change life style
		Middle bush (kavlameiki mlaviaru tripe yavneraketn enawiliyang	2010	<ul style="list-style-type: none"> flooding 	<ul style="list-style-type: none"> Dive for food Relocation

El Nino

Name of province	Island facing problems (La Nina)	Village/are a name	Year	Impacts faced	What did people do in order to survive or cope?
Tafea	Tanna	West Tanna	1991-1992	<ul style="list-style-type: none"> • Water Shortage • Coconut defoliation • Manioc fibre • Kill (man) • Livestock Dead • Water salty 	<ul style="list-style-type: none"> • Water distribution (MvKilian) outer island • Namarei food • Palms ferns • Nip • Nambalako mix with coconut (Bamboo) • Banana stem grading • Bake burau stem • Wild rope • Ferns
		South East			
	Futuna	Whole Island			
	Aneityum	Whole Island			
	Aniwa	Whole Island			
	Erromango	Whole Island			



Appendix VIII: Output 2: Participants give specific examples of climate change impacts in the agricultural sector

Name of province: TAFEA

Name of island and village:

Specify impacts on the following crops	Stem	Leaf/vine	Edible portion	How is the community adapting to the impact?
Extreme WET (La Nina) Yam (Quantity trop) - Nematode - Antracnose	Tuber rotten	Leave dry	Loose of tuber	- Traditional calendar - Alternative cropping - Mix cropping system - Site selection
Extreme Dry (El Nino) Yam (Quantity trop) - Nematode - Antracnose	No grow / death	Wild & Die	No tubers	- Mulching using banana stem / skin - Mulching using sand beach
Extreme Wet (La Nina) Manioc Extreme Dry (El Nino) Manioc	Rotten tubers Reduce plant size		Reduction in tuber size & eating quality	- Harvesting times - Site selection & soil type & structure - Improve farming system, crop diversification & mulching

La Nina Island taro			Reduce tubers (yield) Reduce quality (sizes	<ul style="list-style-type: none"> - Climatic tolerant - Varieties, drainages, relocation & site selection - Crop diversification - Other uses (leaf)
El Nino Island Taro			Corm rot, Pests & disease infestation Reduce yield	
La Nina Island cabbage	Rot	Mildew infestation		Tolerant Varieties, Drainage, Relocation

Name of province: TORBA

Name of island and village:

Specify impacts on the following crops	Stem	Leaf/vine	Edible portion	How is the community adapting to the impact?
Yam [El Nina]	Vines are small	Small leaves	Small produce No produce	<ul style="list-style-type: none"> - Limited sale and consumption of the produce instead they are preserved for planting material.
Manioc [El Nino]	Big stem and roots			<ul style="list-style-type: none"> - Relocated the garden to higher ground or slope
Dry Land Taro	Big	Big leaves		Taro plants have a lot more leaves and there are a lot more plants. Some areas which did not have Taro plants before now grow taro plants
Fiji Taro	Normal	Normal	Normal	Normal
Kumala (El Nino)	Big	Big	No Produce/ Small produce	Leafs are used as pig feed
Island Cabbage	Rotten	Rots quickly	-	Use cabbage tops for planting material
Bread Fruit	Normal	Normal	Rots before it matures and falls down	Preserve the good ones
Kava	Normal	Normal	Slow Growth	Use the produce early
Coconut	Normal	Normal	Normal	-
Banana	Normal	Normal	Production is not too good	Introduce new varieties such as Vietnam Banana and some other varieties.

Name of province: PENAMA

Name of island and village:

Specify impacts on the following crops	Stem	Leaf/vine	Edible portion	How is the community adapting to the impact?
Yam	-Dry and rotten -Fugus -Beatles	Dry Vines	-Small -Cause early maturity	- Alternate food - Wild Yam - Navia
Manioc	-Poor Growth rate	Dry Leaf	-Small -strong -contains a lot of veins -sour	- Not good from boiling, only laplap. - Manio Chips/ flour
Water Taro	-Rot/Dry -Fungus -Beatles	Fungus infected leaves	-Early maturity -Small produce	- Alternate food source - Wild Yam - Navia - Imported food
Fiji Taro		Dry	Small produce	- Use stem for food (Laplap) - Animal feed
Kumala (El Nino)	Fungus		Beatle / Potato	- Other alternative - Measure food
Island Cabbage	Fungus	-Fungus -Leaf rotten -Millipedes		- Bush cabbage
Bread Fruit	Fungus	Fungus	Fruit Flies	- Preserve in bamboo - Traditional preservation
Kava	Fungus Nematodes	Fungus	Low Production	- Drink 2 days kava - Local remedies
Coconut	Beatles	-Prontispa Leaf Miner	-Rat -Less production	- Replant - Clean Plantation
Banana	Beatles	-Dry -Fungus	Small production	Introduce new variety

Name of province: **SANMA**

LA NINA :

Specify impacts on the following crops	Stem	Leaf/vine	Edible portion	How is the community adapting to the impact?
Yam	-	-Black dots on leaves -Pest infected leaves (whole on leaves)	- Skin of the tuber is affected by the soil -Pest &Parasites affect the tuber	<ul style="list-style-type: none"> - Select Yam Variety that is resistant. - Space the yam plants. - Apply preventive measures (Flower).
Manioc	-	Leaves turn yellow and fall	Rotten	<ul style="list-style-type: none"> - Select a variety manioc
Island Taro	Pest and Disease infected stem	-Brown spots -Caterpillar infected	-Pest &Parasites affect the tuber -Fungus affected (rotting)	<ul style="list-style-type: none"> - Select a variety of island taro - Preventive measure (flower)
Fiji Taro	Red Head (Pigeon) eat the stem	Yellow Leaf	- Skin of the tuber is affected by the soil -Beatle eats the tubers	<ul style="list-style-type: none"> - Clean the gardens to make sure that there is no bush
Kumala (El Nino)		Small leaves & leaves roll	-Decrease produce -Rats eat the crops -Pest & Parasites eat the crop	<ul style="list-style-type: none"> -Variety selection -Burn affected crops
Island Cabbage	Fungi	-Yellow leaf -Snails eat the leaves (African snails)		<ul style="list-style-type: none"> -Pick and kill African snails -Burn ash -select island cabbage varity
Bread Fruit	Fungus	Dry and fall	-Flying fox -Early maturity	-Select variety
Kava	Rotten	Dry leaves	Rotten	<ul style="list-style-type: none"> -Remove rotten plants -plant flowers that are natural repellents
Coconut	-Brown spots -Pest & Parasite infected	-Pest & Parasites infected -Brown leaves -Early maturity	-Eaten by rats and Fly fox	Cut and burn
Cocoa	Pest & Parasite (Fungus)	Brown / yellow	-Black pod -Rat	<ul style="list-style-type: none"> -Selective variety -Karting
Banana	Pest & parasite infected	Dry leaves	Early Maturity	<ul style="list-style-type: none"> -Remove and throw away infected plants -plant healthy ones

EL NINO

Specify impacts on the following crops	Stem	Leaf/vine	Edible portion	How is the community adapting to the impact?
Yam	Rotten	Dry and fall	Rotten	-Change garden location -Use mature yams as planting materials as they are not easily infected.
Manioc	Dead	Yellow and fall	Rotten	-Change garden location -Plant varieties that are resistant
Island Taro	Rotten	Rusty, Yellow , Dry	Rotten	-Change garden location -Plant varieties that are resistant
Fiji Taro	Normal	Normal	Normal	Normal
Kumala (El Nino)	-Rotten -No Produce	Increase leaf production no	Rotten	Plant resistant Varieties
Island Cabbage	-Rotten	Yellow leaf	-	Eat other varieties of cabbage - Taro leaf - Cabbage
Bread Fruit	Normal	Ok	No Produce during prolonged sun periods	
Kava	Normal	Ok	Ok	
Coconut	Ok	Ok	Ok	
Cocoa	Ok	Ok	-Less pollination - Black Pod	Remove suckers , Black pod pruning.
Banana	ok	ok	No Produce during prolonged sun periods	

Specify impacts on the following crops	Stem	Leaf/vine	Edible portion	How is the community adapting to the impact?
Yam	Dry	-Black spot on leaves -Dry leaves -Affected tubers	Affected	-Harvest / Consume immediately. -(Tongariki Yam “ Robust”)
Manioc	Fungus	White Bugs	Rotten	Harvest / Consume immediately -move to other locations
Island Taro				
Fiji Taro				

Kumala (El Nino)	Increase stem growth	Dry	No Produce	Change Variety of crop
Island Cabbage	Rotten	Dry	Rotten	Plant resistant species/ Variety
Bread Fruit	-	-	-	-
Kava	Rotten	African snails destroy the leaves	Rotten	Relocate to dry zone
Coconut		-Leaf Bend & spacing (Ema/Epi)	-Fruit Changes size to oval & thin	
Cocoa			Black Pod	
Banana	Nimatodes	Dry Leave	Affected	

AppendixIX: Output 5: A list of specific ways and recommendations that climate services and early warnings can be useful to sectors (including suggestions on timing and presentation of products)

Department /institution name	Service/product provided by VMGD	Ways by which this product is helping your line of work	Preferred timing of product dissemination	Preferred format (e.g. pictures, graphs, numbers)	What type of information do you want to receive	Preferred early warning system
DARD (Agricultural Farmers)	Vanuatu climate Update	Better planning in relation to cultivation following change in the (weather)	Monthly	Table, Pictures and text	Rain and sun	Flooding and landslide
	Agro-met bulletin		Monthly	Table, Pictures and text	Rain and sun, Adaptation	
	Tropical Cyclone seasonal forecast		6 months	Map, Picture story	Wind and rain	
	ENSO warnings		3-6 months	Table, Pictures and text	Adaptation	
	Seasonal forecast (rainfall outlook)		Monthly	Table, Pictures, Graphs and text	Rain and sun	
	Volcano Alert		6 months	Picture story	Acid rain and dry ash	

Department /institution name	Service/product provided by VMGD	Ways by which this product is helping your line of work	Preferred timing of product dissemination	Preferred format (e.g. pictures, graphs, numbers)	What type of information do you want to receive	Preferred early warning system
DARD	Vanuatu climate Update	-Rainfall -Wind direction -Tour planning	2 weeks	-Met Office -Email -Booklet	- Past months rainfall and the coming months rainfall	El Nino La Nina
	Agro-met bulletin	Forecast planning upfront	1 month	-Email -Booklet -Poster	-Rainfall -Temperature - Wind speed	El Nino La Nina
	Tropical Cyclone seasonal forecast	-Touring -Preparedness (awareness) -Crop Planting	3 months	-DVD -Email	- Rainfall -Wind Speed	El Nino
	ENSO warnings	Preparedness	3 months prior to event	-DVD -Booklet - Email -Met Office -Area Council	-TC forecast -Rainfall -Wind speed	El Nino La Nina
	Seasonal forecast (rainfall outlook)	Rainfall forecast	1 month	-Bulletin -DVD	-How much rainfall - Flooding	La Nina

				-Email		
	Climate Data	Planning, Forecast	Upon request	-Email - Printout	-History of Events	ENSO
	Climate science/ projections	Crop Production Projections	Upon request	-Weather Report	-Crop model	El Nino La Nina
	DVD/News letters/pamphlets	Awareness	3 months	Pictures, News letter, DVD	-Weather information. -Training Demonstrations.	El Nino La Nina

Department/institution name	Service/product provided by VMGD	Ways by which this product is helping your line of work	Preferred timing of product dissemination	Preferred format (e.g. pictures, graphs, numbers)	What type of information do you want to receive	Preferred early warning system
LIVE STOCK	Vanuatu climate Update	-Extreme weather information -General weather information -forward plan (breeding/ Rep. Pasture)	3 months	-Picture -Graphic -Numbers	- Rainfall - Temp - Drought - Humidity - Wind	- Flooding - Drought
	Agro-met bulletin	Information Dissemination	Monthly	-Picture -Graphic -Numbers	- Rainfall - Temp - Drought - Humidity - Wind	
	Tropical Cyclone seasonal forecast	-Water Catchment -Preparation -Relocation of livestock -Feed reserve	2 months before cyclone season	-Media - SMS - Livestock extension officers - Provincial networks	Number of cyclones expected	-Flooding -Landslides -Coastal erosion
	ENSO warnings	-Planning -Sale -New Pastures -Water Catchment -Stock maintenance -Disease maintenance	3 monthly	-Media - SMS - Livestock extension officers - Provincial networks	-Duration -Intensity	-Flooding -Drought
	Seasonal forecast (rainfall outlook)	-Planning -Sale -New Pastures -Water Catchment -Stock maintenance -Disease maintenance -Preventive measures	3 monthly	-Media - SMS - Livestock extension officers - Provincial networks	Intensity (duration)	-Flooding
	Climate Data	-Information of Achievements -Planning -M& E	Quarterly	-Picture (Graphics) - Numbers	-Humidity -Rainfall -Temperature -Wind(Dir/Spd) -Drought	
	Climate science/ projections	-Planning purposes -Assist farmers on livestock development	-Upon request by farmers -Quarterly	-News Letter	-Temperature -Rain -Humidity -Drought	

	DVD/News letters/pamphlets	-Information Dissemination -Advisory -Education -Awareness	Biannual	-Real situation -Bislama -Advice/Recommendations	- All VMGD Services	
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Department/institution name	Service/product provided by VMGD	Ways by which this product is helping your line of work	Preferred timing of product dissemination	Preferred format (e.g. pictures, graphs, numbers)	What type of information do you want to receive	Preferred early warning system
FORESTRY	Vanuatu climate Update	-Planning and decision (quarterly plan)	-Monthly -3 monthly's forecast	-Radio -SMS	-Temperature -Wind -Rainfall -Tides	-High rainfall (flooding) -Drought
	Agro-met bulletin	-Planning and decision -Plant Choice spp.	Monthly	-Insert in daily post -Print copies (flyers, posters)	-Temperature -Wind -Rainfall -Choice Spp.	ENSO Early Warning
	Tropical Cyclone seasonal forecast	-Planning and Preparation (6 months plan)	Annually	-Radio -Email -Hard Copies -Guidelines -SMS	- Cyclone outlook	
	ENSO warnings	- Planning and decision	Before it happens	-Agromets Bulletin -Radio Program -Awareness	- ENSO Standard warning system	ENSO warning system
	Seasonal forecast (rainfall outlook)	Planning & Preparation	-3 months forecast - monthly updates	- Radio -Email -SMS -Bulletin	-Rainfall -Temperature - Wind	
	Climate Data	-Planning & report writing	-Upon Request	- Picture - Graph -Actual data	- Rainfall -Temperature - Wind	
	Climate science/projections	-Planning (productivity) -Growth projections	Upon Request	-Data -Graphs -Bulletins -Awareness -Radio	-Rainfall -Temperature - Wind	
	DVD/News letters/pamphlets	-Planning -Awareness	-Upon Request -ASAP	-	-Temperature - Rainfall - Choice Spp - Resilient Spp	

Department/institution name	Service/product provided by VMGD	Ways by which this product is helping your line of work	Preferred timing of product dissemination	Preferred format (e.g. pictures, graphs, numbers)	What type of information do you want to receive	Preferred early warning system
DARD, FORESTRY, LIVESTOCK, FISHERIES, VARTC	Vanuatu climate Update	Advice farmers and stake holders/ officers	2 / week	Table & Pictures	Rainfall, Temperature, Wind	

Appendix X: Agromet recommendations for the National Climate Change & Disaster Risk Reduction Policy

Sector: Agriculture

Theme	Policy Statement or Improvement Strategy
Governance, Coordination and Partnerships	<ul style="list-style-type: none"> - Develop National Agriculture Policy Framework - Institutional strengthening and coordination - Strengthening partnership with stakeholders
Knowledge Base	<ul style="list-style-type: none"> - Strengthen knowledge base in research (DARD/VARTC) - Human resource development
Mainstreaming	<ul style="list-style-type: none"> - Mainstream business plan/job descriptions (JDs) - Mainstream agriculture into other sectoral policies and legislation
Energy and Emissions	<ul style="list-style-type: none"> - Encourage bio-fuel (coconut) - Encourage research on bio-fuel potential - Feasibility study in renewable energy

Sector: Livestock

Theme	Policy Statement or Improvement Strategy
Governance, Coordination and Partnerships	<ul style="list-style-type: none"> - Human resource strengthening - Bye-laws enforcement - Capacity building - Extension network and communication - Commercializing sector - Infrastructure and facilities - Establish Provincial breeding livestock species - Establish Livestock Advisory Board
Knowledge Base	<ul style="list-style-type: none"> - Data and information (undertake baseline information) - Visualize real life situation - Simple language
Community Preparedness and Resilience	<ul style="list-style-type: none"> - Identify problems and issues - Identify solution

	<ul style="list-style-type: none"> - Distribution of recommended livestock species - Distribution of recommended pasture species - Feed formulation of local feedstuff - Livestock modeling - Community livestock training and awareness - Community outlet (markets) - Meat hygiene - Animal health
Mainstreaming	<ul style="list-style-type: none"> - Livestock development and marketing - Linkage with climate (met services) and other sector services during implementation of National Livestock Framework - Review/amend/enforcement of legislation
Energy and Emissions	<ul style="list-style-type: none"> - Bio-sola introduction in communities (model) - Use of manure in integrated farming system

Sector: VMGD

Theme	Policy Statement or Improvement Strategy
Governance, Coordination and Partnerships	<ul style="list-style-type: none"> - Review of job description to include into different sectors. - Improve and upgrade provincial weather station to be response to communities and other users. - Review of acts /legislations - Develop Agromet positions - Institutional strengthening and capacity building
Knowledge Base	<ul style="list-style-type: none"> - Centralize database system - Simplifying scientific information - Build upon existing scientific knowledge and strengthen - Sharing of information and knowledge - Protection of information (copyright)
Community Preparedness and resilience	<ul style="list-style-type: none"> - Improve VMGD products to be timely and meet all needs - Provide timely, accurate, accessible VMGD products and services - Encourage community participation in information sharing - Identify vulnerable areas/risk mapping - Regulate
Mainstreaming	<ul style="list-style-type: none"> - Mainstreaming CCA and DRR planning, strategies and budget - Weather and climate related information integrated into sectoral applications - Mainstream at community level e.g. contingency plans, risk mapping, evacuation plans
Energy and Emissions	<ul style="list-style-type: none"> - Encourage renewable energy - Regulate imported fuel/migrate to low emissions fuel - Implement and enforce appropriate air quality experiments - Tax emitters (e.g. factories, automobiles) - Introduce energy efficiency appliances in homes - Promote bio-fuel

	- Strengthening Energy Department and Regulator (URA)
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Sector: Farmers

Theme	Policy Statement or Improvement Strategy
Governance, Coordination and Partnerships	<ul style="list-style-type: none"> - Strengthening Area Councils - Reinstate AAO - Facilitate market access - Facilitate shareholdings in joint venture (51-49; 60-40 ratios) - Centralize a flexible financing mechanism
Knowledge Base	<ul style="list-style-type: none"> - Facilitate information/knowledge in animal husbandry - Technology transfer - Improve access to planting materials - Facilitate agromet information to farmers through all means of communication
Community Preparedness and resilience	<ul style="list-style-type: none"> - Strengthen/increase community infrastructure e.g. road, wharf, warehouses - Strengthen traditional governance - Promote common good
Mainstreaming	<ul style="list-style-type: none"> - Promote collaboration between Area Councils and technical agency, institution - Farming guides (guide book/handbook/videos) on CC/DRR
Energy and Emissions	<ul style="list-style-type: none"> - Promote renewable/appropriate energy sources - Improve carbon sinks through REDD+ - Promote sale of biomass energy to main grid - Promote energy efficiency

Sector: Forestry and Environment

Theme	Policy Statement or Improvement Strategy
Governance, Coordination and Partnerships	<ul style="list-style-type: none"> - Facilitate coordination and collaboration between Forestry Dept and Climate Change Policy and Environment (MOUs signed) - Climate change policy must be linked to, and harmonized with Vanuatu's other sectoral policy - Participation of all relevant stakeholders
Knowledge Base	<ul style="list-style-type: none"> - Identify and seek financing for novel and promising forestry adaptation projects and programmes (all stakeholders) - Train govt officers on the opportunities for climate change adaptation and impact assessment (NACCC) - Systematically assess and continuously monitor the impacts of climate on forest system (i.e. through Permanent Sample Plots – PSP's) – DOF, NACCC

	<ul style="list-style-type: none"> - Develop and regularly update a data base of climate change adaptation information in the Vanuatu Forest Sector - Integrate Forest Sector priority areas as an approach to climate change mitigation issues - National coordination on monitoring of international negotiation process on Forest and climate change - Formalize procedures for national and international forest projects in Vanuatu under the compliance and voluntary carbon markets (NACCC, VIPA, DOF, DNA) - Facilitate the efficient collection of biodiversity data (indigenous flora) that can be affected as a result of climate change
Mainstreaming	<ul style="list-style-type: none"> - The Forestry sector, Department of Environment Protection and Conservation proactively address and incorporate climate change adaptation and mitigation challenges – implementing agent - Climate change policy should adopt/incorporate the National Forest Policy component relating to climate change - Raise awareness of stakeholders on forestry climate adaptation opportunities in Vanuatu and developed related materials (DOF, NACC, NGOs, Env) -
Energy and Emissions	<ul style="list-style-type: none"> - Automotive dealers to pay tax into trust fund controlled by VMGD/PMU? - Biofuel (Fuel wood powered machinery) - REDD+ guidelines adopted - Facilitate the funding of PAs and CCAs