National Climate Change Adaptation Strategy
for Land-Based Resources
(2012 – 2022)

Second Draft
July, 2011
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**Executive Summary**

The environment of Vanuatu including its land based resources are extremely vulnerable to climate-related hazards, such as cyclones, strong wind gusts, droughts, heat spells, floods, and sea level rise/storm surges. Most of these hazards are precipitated by natural weather phenomena and therefore will be exacerbated by the current and future impacts of climate change. This vulnerability is a threat not only to the livelihoods of the people of Vanuatu but also to a healthy and prosperous nation.

This national climate change adaptation strategy (NCCAS) lays out an approach to identify and implement efficient and effective activities to manage the existing and anticipated consequences of climate change for the land-based resources sectors in Vanuatu, namely forestry, agriculture, water, livestock, and biodiversity/natural ecosystems. These sectors play dominant and essential roles in the economy of Vanuatu and contribute to livelihoods and the general well-being of people and the country as a whole.

The NCCAS is aligned with and builds on existing strategies, policies and action plans. For example, it builds on Vanuatu’s National Adaptation Programme of Action (NAPA), the Priorities and Action Agenda (PAA) or the Disaster Risk Reduction and Disaster Management National Action Plan (NAP) and sector specific documents like the National Biodiversity Conservation Strategy or the National Water Strategy.

It is not just a strategy for government, but actively involves civil society including churches, youth organizations and other NGOs working in the land based resources sector in an active process to cope with climate change in a coherent and strategic manner. For each sector it describes adaptation strategies that are usable, practical and implementable.

The NCCAS consists of two parts, with Part 1 – “Front End”, a high level document that provides the national roadmap on climate change adaptation for the land based resources management, and Part 2, consisting of practical and sector specific adaptation measures and action plans that can be implemented at community level.

**Contents of Part 1 – Front End**

1) **Introduction:**
The essential background of the NCCAS including the aim of the strategy, information on the timeframe, how it has been developed and how it is linked with other policies and strategies, such as the NAPA.

2) **Vision**
The long-term vision of this strategy which might not necessarily be achieved during its current implementation period or by the NCCAS alone.

3) **Objectives**
The specific milestones which will be achieved by the NCCAS.

4) **Guiding principles**
The principles that have been used to set up this strategy and that are important elements for its implementation.

5) **Summary of Vanuatu’s climate and anticipated changes**
The historic changes in the climate of Vanuatu, the observed and experienced impacts and vulnerabilities as well as the underlying drivers.

6) Recent and anticipated risks and vulnerabilities
The impacts and vulnerabilities under projected climate and socio-economic conditions. This chapter also explains the existing adaptive capacities to cope with these impacts and provides information on the adaptation gap, the amount of adaptation required to effectively cope with climate change and disasters.

7) An overview of adaptation options
The potential responses by sectors to reduce these current and future impacts and vulnerabilities (menu of options) and how they can be implemented.

8) A policy review
The review of existing regional and national policies, strategies and action plans including sector specific and crosscutting documents which contain relevant information and actions for adaptation.

9) An institutional review
A stocktake of existing institutional structures do address climate change and disaster management as well as recommendations how the current institutional set up can be improved to address the future challenges effectively and efficiently.

10) Action plans
The final set of sector specific actions, based on the menu of options (chapter 7) and summarized in an implementation schedule, including responsible agencies, stakeholders, timeframes as well as funding channels and indicators for monitoring.

11) Cross-cutting considerations
A summary of risks and opportunities that affect more than one sector as well as information on how to prevent mal-adaptation by a effective sector coordination on national, provincial and area/island level.

12) Recommendations
A description of measures, to support the effective implementation of adaptation actions within the timeframe of this strategy and beyond.

Contents of Part 2 – Sector Adaptation Action Measures
Part 2 consists of sector specific action plans including a set of adaptation strategies that are
- based on the local needs
- detailed
- practical
- Vanuatu-specific
- based on custom & culture
- tried and tested by Vanuatu communities and individuals
- immediately implementable by departments, individuals, communities, NGOs, donors and others
This NCCAS will therefore be the guiding document and foundation for all upcoming climate change adaptation initiatives, programmes and projects implemented in Vanuatu.

Acknowledgements

Many people contributed to the thinking process behind the preparation of the National Climate Change Adaptation Strategy. A large number of representatives of the following Ministries, Departments and services have provided valuable inputs and guidance, including of: the National Advisory Committee on Climate Change (NACCC); the Ministry of Agriculture, Quarantine, Forestry and Fisheries, including the Department of Forests, Department of Agriculture and Rural Development; the Department of Environmental Protection and Conservation; the Vanuatu Quarantine and Inspection Service; the Department of Geology, Mines and Water Resources; the Department of Lands; the Vanuatu Meteorological Service; the Office of the Prime Minister; the Ministry of Justice; the Department of Finance; and the Vanuatu Agriculture Development Bank.

The contributions provided by representatives from GIZ and SPC’s Land Resources Division are also gratefully acknowledged.

In addition, the authors are grateful to the many people from around the Republic of Vanuatu who provided valuable information and ideas throughout the consultation process, particularly to all stakeholders who attended the regional workshops and consultations.
1. Introduction

This National Climate Change Adaptation Strategy (NCCAS) is designed to guide the implementation of efficient and effective activities to manage climate change impacts on the land-based resource sectors1 in Vanuatu2. The NCCAS sets out a systematic, long-term approach for embedding climate change adaptation into core sectoral functional activities. Programmatic rather than project focused, the NCCAS addresses sector and national needs, and contains specific and practical actions. Sector specific action plans included in the NCCAS describe how commitments will be translated into concrete actions, how changing circumstances will be accommodated, and how risks and barriers will be addressed. The sector action plans detail substantive interventions to address adaptation needs, and specify the allocation of responsibilities and definitive implementation timelines.

In summary, for the land-based resources sectors the NCCAS considers:

- impacts/vulnerabilities that have been observed/experienced, and underlying drivers
- impacts and vulnerabilities under projected climate and socio-economic conditions
- appropriate responses to reduce vulnerabilities and how best to implement them

Importantly, the NCCAS is aligned with existing strategies, policies and action plans.3 For example, it builds on Vanuatu’s National Adaptation Programme of Action (NAPA). The latter focuses on “urgent and immediate” adaptation actions, is project based and has no action plan for implementation. In contrast, the NCCAS is programmatic and strategic as well as focused and practical, addresses both immediate and longer-term needs and includes action plans for implementation.

The strategy also highlights a pathway for the mobilization of resources, including country- and needs-driven financial and technical assistance. Accordingly, the NCCAS is intended to be a strategic, whole of country and living document.

Prepared by Vanuatu stakeholders using inclusive and participatory processes, the NCCAS is relevant to the target sectors as well as more widely to Government, civil society, the private sector and development partners. It is lays a foundation effective climate change coordination among all relevant stakeholders.

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1 forestry, agriculture, water, livestock, and biodiversity/natural ecosystems.
2 These sectors play dominant roles in the economy of Vanuatu and contribute to livelihoods and the general well-being of people and the country as a whole. Importantly, both experience and evidence reveal these sectors' high sensitivity to weather extremes as well as climate variability and change.
2. Vision

The following vision highlights the commitment of the people and Government of Vanuatu to being well prepared for a changing climate (in the context of other concurrent changes in the environment, economy, and society):

Vision:
The people and Government of Vanuatu are strongly committed to, and actively involved in, a nationwide ongoing collaborative process of adapting to climate change with the goal to build and sustain a healthy, resilient and prosperous nation.

Achieving this vision of the NCCAS will require meaningful changes to policies, regulations and institutions in order to provide incentives for behavioural changes by all actors at all levels (including government, non-governmental organisations, communities, families, the private sector, and individuals). Success will require actors to respond to the impacts of climate change that have already been observed, while taking pro-active steps to understand and prepare for future climatic changes and the likely impacts.

Objectives and guiding principles have been developed to support these efforts (see Sections 3 and 4). These principles have influenced both the design of the NCCAS and the actions to be undertaken as part of its implementation.
3. Goal and objectives

Adapting to climate change by the land-based resources sectors will require a pragmatic approach that progressively and continuously assesses needs and implements appropriate adaptation measures in cooperation with all relevant stakeholders. The process of implementing the NCCAS will provide the opportunity for all people of Vanuatu to gain a profound understanding of:

- the existing and expected climate changes in Vanuatu,
- the resultant impacts and risks to land-based activities and resources, and
- appropriate and practical actions to address and mitigate these risks.

The medium- to long-term goal of the NCCAS is to position Vanuatu to cope well with the current and anticipated impacts of climate change by reducing the vulnerability of and enhancing the adaptive capacities of our people and our environmental, social and economic resources and systems.

To achieve this goal, the NCCAS sets out to achieve the following objectives:

- Identify and analyze climate risks based on the most recent climate change projections for Vanuatu\(^4\) and the region, and assess how the anticipated changes will impact on Vanuatu’s land based resource sectors
- Provide a comprehensive list of Vanuatu specific, appropriate and prioritized adaptation strategies and actions at all levels (based on the analysis above and taking into account social, equity, institutional, policy, technical, environmental, economic, financial, gender and other relevant considerations)
- Recommend ‘implementation pathways’ that contribute to minimizing the adverse impacts of climate change on land-based resources and sectors, particularly those which address both the preparedness for and response capacity to climate change impacts and extreme events;
- Provide government and other decision makers with concise climate change policy recommendations (to the extent possible and including associated uncertainties) with reference to time-frames, locations and spatial scales that are of direct and immediate relevance; and support them with practical tools and guides to promote the best possible management of climate impacts on land-based resources;
- Encourage the continued development and application of targeted public outreach measures to increase knowledge and awareness among all people of Vanuatu about the risks posed by climate change, and provide guidance on how incorporate this knowledge into their planning and decision making;
- Achieve widespread recognition that adaptation to climate change is much broader than an exclusively environmental issue (a misunderstanding which often constitutes a significant institutional barrier to mainstreaming adaptation into sectoral policies) and treat adaptation as a development issue that is relevant and important to economy as a whole and the prosperity and

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4 These projections will include outputs from VanuaClim software, the Pacific Climate Change Science Programme and other analyses and be consistent with the 2011 Second National Communication
wellbeing of Vanuatu and its people. This shall be reflected in the recommendation that all ministries, including those responsible for planning and finance, take ownership of the issue;

- Link and coordinate Vanuatu efforts in climate change adaptation (CCA) and disaster risk reduction (DRR) and management (DRM), as policy frameworks and practical methodologies are synergistic. Both policy areas aim to achieve a reduction of vulnerability to the impacts of climate change and variability, and both depend on evaluating risks, vulnerabilities and remedial options. Foster strategic coordination, including an exchange of information, experience and tools, thus considerably contribute to improving the sustainability of development processes;

- Highlight ways to strengthen the governance and institutional arrangements of climate change in Vanuatu and clearly define responsibilities in order to enable effective and efficient implementation of adaptation strategies and actions; this includes identifying and addressing barriers to adaptation that may be inherent in existing policies, regulations and processes.
4. Guiding Principles

The following guiding principles underpin the design and implementation of the NCCAS including the selection of adaptation strategies, which shall be:

- **Relevant, appropriate and proportional**

  Threats and opportunities resulting from climate change will impact on different islands, sectors, activities and resources in different ways. Also, the capacity of different actors to adapt to climate change varies largely. It is therefore important that the adaptation measures included in the NCCAS take account of these variations and are tailored, where possible, to suit the specific geographic, sectoral, institutional, cultural and other relevant contexts in which they will be implemented. The strategy provides for flexibility in decision-making and implementation, so that measures are taken at the most appropriate level — local, regional/island or national. Adaptation measures should be cost-effective, commensurate with the climate-related risks and, where possible, also take advantage of the opportunities created by a changing climate.

- **Collaborative and coordinated**

  Recognizing that adaptation to climate change affects the society as a whole, and that no single sector or actor can effectively respond to climate impacts by working alone, the NCCAS shall foster dialogue and collaboration between actors at all decision-making levels, including national, regional and local governments, non-governmental and community organisations, academia, the private sector and individuals. All stakeholders need to be given the opportunity to inform the design of the NCCAS and be involved in its implementation in a structured and coordinated way. Adequate public outreach strategies, such as communication and education strategies, are essential to securing broad public support for the NCCAS.

- **Facilitated and guided by traditional knowledge**

  When designing and implementing adaptation measures particular attention should be paid to building on traditional knowledge and practices of land management, biodiversity conservation etc., which are often already (and have been for millennia) facilitating adaptation to climate variability and extremes. Communities that rely heavily on land based resources for their livelihoods experience the impacts of variations in weather and climate firsthand, and have built a vast repertoire of valuable knowledge that complements scientific approaches to understanding climate change. In particular, traditional knowledge on climate should be used where local scale expertise is needed, for instance as a source of climate history and baseline data; to provide insight into local scale impacts and adaptation options; and for long term, community-based monitoring.

- **Integrative and synergistic**

  For an adaptation strategy to be effective, it must take into account inter-dependencies among sectors and policies, recognizing that actions in one sector or field of activity may have repercussions on other sectors and the success of their interventions. Therefore, adaptation actions cannot be carried
out in isolation, but must be designed and implemented to take advantage of synergies and prevent adverse interactions of diverse policy objectives. Ideally, the adaptation measures highlighted in the NCCAS will complement or directly support existing sector policies and initiatives.

- **Evidence-based and adjustable**

Actions identified in the NCCAS should be based on the best available traditional and scientific knowledge of climate change impacts, threats, vulnerabilities and adaptive measures. In this context, it is important to acknowledge that there will always remain some uncertainties with regards to the exact nature, intensity, temporal and geographic distribution of climate change impacts, however incomplete knowledge shall not be used as an excuse for inaction. The NCCAS is designed to allow for strategies and actions to be adjusted as knowledge evolves over time. Where opportunities exist to drive the development and expand the use of new information, technologies and technical skills, these should be exploited.

- **Measurable and flexible**

It is critical that implementation of the NCCAS be monitored and continuously evaluated. Therefore, measurable adaptation goals, objectives and performance metrics must be identified that allow for outcome evaluation. However, due to the complex interrelationships between different sector strategies, actions and policies, it will likely be difficult to establish a clear, unambiguous and direct causal link between objectives, goals and resulting outcomes. Also, the quantitative data necessary to measure outcomes may not (yet) be readily available. In such instances, proxy indicators should be developed to provide approximate information regarding achievements made. Flexibility is key to building a robust and resilient process and so the NCCAS should allow for adjustments to be made on the basis of ongoing evaluation.
5. Vanuatu’s Climate, and Anticipated Climate Changes

Vanuatu is extremely vulnerable to natural disasters. Those that are weather- and climate-related are likely to be exacerbated by global warming. Changes over time reflect the influence of global warming.

According to the IPCC, the following messages have been endorsed by the workshop participants as a starting point for developing NACCC-approved CC messages in Vanuatu:

1. **Sea level** in Vanuatu has risen, and will continue to rise, due to global warming and other factors. Vanuatu acknowledges the predictions of the Intergovernmental Panel on Climate Change (IPCC). According to the IPCC, sea level is projected to rise between the present (1980–1999) and the end of this century (2090–2099) by 0.35 m (0.23 to 0.47 m).

2. **Temperature** (of the air, land, and sea) in Vanuatu has increased, and will continue to increase, due to global warming. Vanuatu acknowledges the predictions of the Intergovernmental Panel on Climate Change (IPCC). According to the IPCC, annual temperature is projected to rise between the present and the end of this century (2080 to 2099) by 1.8°C (1.4°C to 3.1°C).

3. **Rainfall** patterns in Vanuatu have changed, and will continue to change, due to climate change. Vanuatu acknowledges the predictions of the Intergovernmental Panel on Climate Change (IPCC). According to the IPCC, annual precipitation is projected to increase over the southern Pacific by close to 3% (–4 to +11%). Most of these increases are predicted to be in the first half of the year. However, changes in rainfall variability in the South Pacific will be strongly driven by changes in ENSO, although this is not well understood.

4. **Extreme Events** (cyclones, floods, droughts) in Vanuatu may become more frequent and more severe. Vanuatu acknowledges the predictions of the Intergovernmental Panel on Climate Change (IPCC). According to the IPCC, ENSO fluctuations have a strong impact on patterns of tropical cyclone occurrence in the southern Pacific, and this contributes to uncertainty with respect to tropical cyclone behaviour.

5. **Local ways of life** in Vanuatu will be negatively affected. Vanuatu acknowledges the predictions of the Intergovernmental Panel on Climate Change (IPCC). According to the IPCC, climate change in the Pacific may lead to:
   a. Accelerated coastal erosion, saline intrusion into freshwater lenses and increased flooding from the sea
   b. Less rainfall coupled with accelerated sea-level rise compound the threat on water resources
   c. Degradation in the health of coral reefs around islands

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5 According to the Commonwealth Vulnerability Index—based on: (a) the impact of external shocks over which an affected country has little or no control and (b) the resilience of a country to withstand and recover from such shocks—Vanuatu ranks as the world’s most vulnerable country out of 111 developing countries assessed.

6 El Nino Southern Oscillation
d. Variable rainfall will cause soil degradation and loss of soil fertility which will negatively impact on agriculture and food security

e. If the intensity of tropical cyclones increases, a concomitant rise in significant damage to food crops and infrastructure is likely

f. Decline in the total tuna stocks and a migration of the stock eastwards, both of which will lead to changes in the catch in different countries

g. Impacts on infrastructure including closure of roads, airports and bridges due to flooding and landslides, and damage to port facilities (impacting other sectors and services including tourism, agriculture, the delivery of health care, clean water, food security and market supplies)

h. Reduced attractions for coastal tourism

i. Sea-level rise and increased sea water temperatures are projected to accelerate beach erosion, cause degradation of natural coastal defences such as mangroves and coral reefs, and result in the loss of cultural heritage on coasts affected by inundation and flooding

i. Declining human health

j. Rural and inland settlements and communities are more likely to be adversely affected by negative impacts on agriculture, given that they are often dependent upon crop production for many of their nutritional requirements

j. More prevalent climate-sensitive diseases, including morbidity and mortality from extreme weather events, certain vector-borne diseases, and food- and water-borne diseases

k. Tropical cyclones, storm surges, flooding, and drought affect human health, by drowning, injuries, increased disease transmission, decreases in agricultural productivity, and an increased incidence of common mental disorders

l. Weather is conducive to the transmission of diseases such as malaria, dengue, filariasis, schistosomiasis, and food- and water-borne diseases

m. Increasing temperatures and decreasing water availability due to climate change may increase burdens of diarrhoeal and other infectious diseases

n. Warmer sea surface temperatures during El Niño events have been associated with ciguatera outbreaks

Best estimates of long term, systematic changes in the average climate for Vanuatu indicate that by 2050 sea level is likely to have increased by 20 cm, maximum air temperatures by 0.2 °C, maximum water temperatures by 0.19 °C, extreme wind gusts by 6.8% and rainfall by 0.6%.

There is relatively high confidence in projections of maximum air temperature. Measurements at three sites in Vanuatu show maximum daily air temperatures of between 35 °C and 37 °C are currently approximately 150-year events. By 2050 these are likely to be approximately 50-year events. There are similar projections for extreme water temperatures. A maximum water temperature of 33.5 °C is currently a one in 200-year event at Port Vila. It will likely be a one in 50-year event by 2050.

Less certainty exists in projections for extreme wind gusts. However, a current one in 150-year event of a maximum daily wind gust of 40 kts is likely to be a one in 60-year event by 2050.
The observed annual rainfall shows an increase at some locations and a slight decrease at others. Currently a daily rainfall of at least 350 - 400 mm is a relatively rare event at the measurement sites in Vanuatu, with return periods of between 80 and 120 years. There is large uncertainty in the rainfall projections, with some models suggesting substantial increases in rainfall, other models suggesting only small increases, and even other models indicating a small decrease in rainfall into the future. An extreme daily rainfall of at least 350 mm at these sites will likely have return periods of between 60 and 80 years by 2050.

**Uncertainty in Climate Projections.** All climate projections are subject to uncertainties, due in part to assumptions associated with modelling the changes and with estimating future emissions of greenhouse gases. Figures 6 and 7 show the level of uncertainty associated with projections of sea level and rainfall, respectively.

Best estimates of future sea-level rise and rainfall are based on an average of the estimates using a multi model and emission scenario ensemble. Figure 6 shows the best estimate of mean sea level out to 2100, as well as the band of extreme uncertainty. The latter is estimated using the highest and lowest estimates of sea-level rise for all model and emission scenario combinations.

![Figure 6](image-url)  
*Figure 6* Best estimate of projected increase in mean sea level for Port Vila, along with the uncertainty envelope as given by the maximum and minimum estimates using all possible combinations of the available global climate models and emission scenarios.
Figure 7 shows the best estimate of mean daily rainfall out to 2100, as well as the band of extreme uncertainty. The latter is estimated using the highest and lowest estimates of rainfall projections for all model and emission scenario combinations.
6. Recent and Anticipated Risks and Vulnerabilities

6.1 Vulnerabilities

Vanuatu is already highly vulnerable to a range of natural disasters, many of which will be exacerbated by climate change. Most of the islands are mountainous and of volcanic origin and have a tropical or sub-tropical climate. Vanuatu was in 1996 classified as highly vulnerable to all natural hazards: tropical cyclone, storm surge, coastal flood, river flood, drought, earthquake, land-slide, tsunami and volcanic eruptions (UNFPA, 1996) and is ranked alongside Solomon Islands as the most disaster prone nation in the region. SOPACs Environmental Vulnerability Index classified Vanuatu in 2005 as vulnerable to natural hazards caused by disasters and climate change with an index of 285 (SOPAC, 2005).

The vulnerability of Vanuatu’s society and economy in general, or specific sectors to the effects of climate change depends not only on the magnitude of current and future climatic stresses, but also on the sensitivity and capacity of affected sectors, groups and individuals to adapt to or cope with such stress. Box 1 provides a definition of sensitivity, adaptive capacity and vulnerability and gives practical examples how these terms are applied.

Sensitivity to climatic stress is higher for activities entailing climate-dependent natural resources, such as agriculture and coastal resources – often critical for the livelihoods of Vanuatu’s population. The capacity to adapt and cope depends upon many factors, including wealth, technology, education, governance institutions, information, skills and access to resources, which are all generally scarce in ni-Vanuatu communities.

Poverty is therefore an important determinant of vulnerability to climate change; and precarious livelihoods will be further challenged through climate change. Lower-income groups are hit hardest because of greater sensitivity (e.g. those living in makeshift or traditional housing on unsafe and/or remote sites) and less capacity to cope and adapt (e.g. lack of assets and insurance). There are strong complementarities between reducing poverty and reducing vulnerability to climate change, e.g. higher education increase the adaptive capacity of households.

The concept of vulnerability therefore recognises that socio-economic systems play a crucial role in amplifying or moderating the impacts of climate change.

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**Box 1**

CLIMATE CHANGE SENSITIVITY, ADAPTIVE CAPACITY AND VULNERABILITY

**Sensitivity** is the degree to which a system can be affected, negatively or positively, by changes in climate. This includes change in mean climate and the frequency and magnitude of extremes. The effect may be direct (for example a change in crop yield due to a change in temperature) or indirect (such as damage caused by increased frequency of coastal flooding due to sea-level rise). Sensitivity includes **exposure** which considers the nature and magnitude of climate change and whether a system would be affected by such change. For example, the lowlying coastal areas of Vanuatu are exposed to sea-level rise, whereas the mountainous inland, because of its elevation, is not. Sensitivity also considers the extent to which an exposed system can be affected by climate change. Some Vanuatu systems, like taro agriculture, are quite sensitive, while other systems, such as Tuscker beer manufacturing, are much less sensitive to climate change, although they can be affected by extreme events, reductions in water supplies, and power disruption.
Adaptive capacity is a system’s ability to adjust to climate change (including climate variability and extremes), to moderate potential damage, to take advantage of opportunities or to cope with consequences. It is a function of the relative level of a society’s economic resources, access to technology, access to information on climate variability and change, and skills to make use of the information, institutions (for example, the degree to which institutions can help to adapt), and equitable distribution of resources (societies with relatively more equitable resource distribution will be better able to adapt than societies with less equitable distribution). An adaptation gap is the amount of additional adaptation required to cope with climate change, including changes in climate variability. The level of adaptive capacity tends to be positively correlated with the level of development: more developed societies tend to have more adaptive capacity. However, possessing adaptive capacity is not a guarantee that it will be used effectively.

Vulnerability is the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude and rate of climate change, and the degree to which a system is exposed, along with its sensitivity and adaptive capacity. Vulnerability increases as the magnitude of climate change or sensitivity increases, and decreases as adaptive capacity increases.

Climate change is also likely to differentially affect certain sectors and regions. For example, certain coastal and marine ecosystems, such as mangroves and coral reefs will be subject to multiple stresses. Climate change will affect many key resources that are critical for development in Vanuatu. These impacts will generally become more significant and more widespread with increasing climate change. For example, water resources especially in small islands will be affected by changes in rainfall and evapotranspiration. Low lying coastal systems will be affected by sea-level rise and more frequent extreme weather events.

Similar to the changes in climate as presented in chapter 5 of this strategy - the NAPA predicts the following scenarios for Vanuatu:
- Gradual increase in temperature which becomes more marked in the south
- Gradual decline in rainfall

Source: OECD, 2009 (adapted)
• Significant increase in frequency of tropical cyclones including more frequent El Nino type conditions associated with prolonged dry seasons

When addressing adaptation to climate change and disasters, the first step is to identify the vulnerability of the systems of interest – the land based resources and the people who depend on them - and the climate risks to that system.

In addition to assessing current vulnerability and climate risks – as presented in chapter 5 - an assessment of future vulnerability and future climate risks needs to be carried out. In order to understand possible future vulnerability, a qualitative understanding of the drivers of vulnerability must be compiled. However the key is not so much to develop perfect information on a system of concern, but to ensure sufficient information to enable thoughtful consideration of adaptation options.

The following table is therefore summarizing the vulnerabilities for each sector and each province.

Table:

[Include updated information on sector and local vulnerabilities based on SimCLIM projections or other sources once available]

6.2 Sensitivity and Adaptive Capacities

Sensitivity and adaptive capacity - especially at the local level - are influenced by many factors, e.g. income level, education, settlement patterns, infrastructure, ecosystem and human health, gender, political participation and individual behavior. Moreover, they shape the way in which people are able to reduce exposure to, cope with, and/or recover from negative impacts of climate change or, alternatively, take advantage of the opportunities afforded by climate change.

On the other side, individuals, households, communities and municipalities have longstanding experience in responding to climate variability and change (see chapter 7).

77 The identification of current and future vulnerabilities and climate risks is step 1 in a generic four-step systematic approach developed by the OECD that decision makers can take to address adaptation to climate change on national, sectoral and local level. (OECD, 2009)
These coping strategies can be used to form the basis of successful adaptation strategies. However, some of these coping strategies could prove to be unsustainable over time as climate change progresses, leading to a greater risk of maladaptation (see box).

**Box 3**

**DEFINITION OF MALADAPTATION**

*Maladaptation* is defined as business-as-usual development which, by overlooking climate change impacts, inadvertently increases exposure and/or vulnerability to climate change. Maladaptation could also include actions undertaken to adapt to climate impacts that do not succeed in reducing vulnerability but increase it instead.

Example: Short-term adaptation strategies of the water sector in response to a decrease in rainfall could include over-exploitation of groundwater resources, which could actually exacerbate vulnerability over the longer term.

Source: OECD, 2009 (adapted)

Adaptation to climate change therefore requires a bottom-up thinking approach which is reflected in this NCCAS. Local knowledge on climate change and response options enlarges the overall management capacities, e.g. climate information from local observation may bring essential information far beyond meteorological observation. It also ensures that the final adaptation strategies reflect the needs of local people and communities thus triggering an locally “owned” development process which is especially important to ensure sustainability and to avoid conflicts.

Climate change is thus likely to impact on all sectors that are pertinent to the sustainable development of Vanuatu. For Ni-Vanuatu, the local population, their livelihood and social structure are closely linked to the natural environment and its resource base, and any negative changes in their availability to natural resources and possible decrease in the food security will have a direct bearing on the poverty levels and survival of the people.

### 6.3 Agriculture and Livestock Sector - Vulnerabilities, Sensitivity and Adaptive Capacities

[needs to be updated by the NACCC and local stakeholders]

The majority of the rural population of Vanuatu is engaged in agricultural production for subsistence with limited cash cropping. The main agricultural products are copra, kava, cocoa, coffee, taro, yams, fruits and vegetables. While large commercial farms and plantations are making a significant contribution to the cash economy of Vanuatu, approximately 80% of the population reside in rural areas and depend on small agricultural plots for their livelihood.

Vanuatu's environment is ideally suited to raising beef cattle. The production of beef, pork, poultry, sheep and goat for local consumption forms an essential part of the rural economy. (FAO, 2007)
The following table is summarizing the current impacts, sensitivities to climate change as well as the current adaptive capacity.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Agriculture – Crop Production</th>
<th>Agriculture – Livestock Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact</td>
<td>Current Sensitivity to Climate Change</td>
<td>Current Adaptive Capacity</td>
</tr>
<tr>
<td></td>
<td>- Droughts</td>
<td>- traditional multicropping methods</td>
</tr>
<tr>
<td></td>
<td>- Heat spells</td>
<td>- increasing the number of small farm plots (involvement of rural dwellers)</td>
</tr>
<tr>
<td></td>
<td>- Cyclones</td>
<td>- sustainable and affordable management practices for traditional crop production</td>
</tr>
<tr>
<td></td>
<td>- Wind gusts</td>
<td>- xxx</td>
</tr>
<tr>
<td></td>
<td>- Floods</td>
<td>- veterinary services available on Efate and Espiritu Santo</td>
</tr>
<tr>
<td></td>
<td>- Sea level rise / salt water intrusion</td>
<td>- grazing of cattle under coconut plantations</td>
</tr>
<tr>
<td></td>
<td>- majority of ni-Vanuatu depend on agriculture (subsistence agriculture and limited cash cropping)</td>
<td>- xxx</td>
</tr>
<tr>
<td></td>
<td>- small farm sizes</td>
<td>- small farms</td>
</tr>
<tr>
<td></td>
<td>- little incentive to introduce modern equipment and methods</td>
<td>- lack of shade trees</td>
</tr>
<tr>
<td></td>
<td>- low productivity</td>
<td>- small farmers rely on streams for water supply</td>
</tr>
<tr>
<td></td>
<td>- commercial and subsistence agriculture are based on rain-fed agricultural production systems</td>
<td>- low nutritional value of pastures (for cattle)</td>
</tr>
<tr>
<td></td>
<td>- most farmers are isolated with poorly maintained access roads</td>
<td>- overstocking of small scale livestock (poultry)</td>
</tr>
<tr>
<td></td>
<td>- little additional information on co-impacts on crops such as yams, taro and sweet potatoes</td>
<td>- lack of veterinary services outside Efate and Espiritu Santo</td>
</tr>
<tr>
<td></td>
<td>- lack of food storage and preservation</td>
<td>- xxx</td>
</tr>
<tr>
<td></td>
<td>- lack of water storage facilities</td>
<td>- veterinary services available on Efate and Espiritu Santo</td>
</tr>
</tbody>
</table>

6.4 Forestry Sector - Vulnerabilities, Sensitivity and Adaptive Capacities

[needs to be updated by the NACCC and local stakeholders]

Vanuatu possesses excellent soil and climate that are conducive to timber production. According to the National Forest Inventory of 1993, approx. 74 % of the land area (about 900 000 hectares) are covered with different forest types\(^8\), or considered as other wooded land. Although about 890 000 hectares of this is still natural forests, the production forest occupies only 36 % of Vanuatu's land area.

\(^8\) Definitions, see Appendix 1 of Vanuatu's National Forest Policy
(Tate, 2008), and only about 20% of it are of commercial use - mainly due to inaccessibility, low tree density, cultural reasons, or because it has already been heavily logged during the eighties and nineties (Forest Policy, 2010). In the year 2000, the forestry sector contributed Vt295 million (approx. 0.9%) to the GDP (Nat. Statistics Office, 2010 / Forest Policy, 2010). The importance of Vanuatu’s forests can not be judged on economic benefits alone. Apart from providing job opportunities, income, and badly needed infrastructure, the development of the forest resources also stimulates activities within the whole economy. The concept of sustainable forest management in Vanuatu must be tempered by the fact that there is no government-owned forest land, and that it is an inalienable right of landowners under the Constitution to manage their land as they see fit. However, given the decreasing forested area and the threat of further damage through extreme climatic events, a sustainable forest industry for Vanuatu can only be achieved through a collaborative effort by the government, the landowners and the industry (FAO, 2007).

Mangroves are productive ecosystems that are important to the livelihoods of coastal communities. Many fish and other marine species breed and live in mangrove areas and yet, many such areas are being destroyed or converted to other uses. Mangrove forests also play an essential role in protecting the coast against storms and inundation. Mangrove areas are believed to be declining in Vanuatu, even in certain isolated areas where population densities remain low. Pollution from land-based activities is perceived as the most common threat to mangrove areas although land clearing is also a threat. Mangrove ecosystems will certainly be affected by climate change events. Sea level rise could affect growth and productivity while storms and associated heavy rain can cause pollution thereby affecting breeding and spawning grounds for many fish species that live in mangrove areas. (FAO, 2007)

The following table is summarizing the current impacts, sensitivities to climate change as well as the current adaptive capacity

<table>
<thead>
<tr>
<th>Sector</th>
<th>Forestry Impact</th>
<th>Current Sensitivity to Climate Change</th>
<th>Current Adaptive Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forestry</td>
<td>- Droughts</td>
<td>- lack of financial competitiveness with agricultural land (risk of forest conversion due to higher demand for agricultural land caused by climate change)</td>
<td>- natural resistance of sustainably managed native forests</td>
</tr>
<tr>
<td></td>
<td>- Heat spells</td>
<td>- monocultures subject to wind gusts, pests and diseases</td>
<td>- xxx</td>
</tr>
<tr>
<td></td>
<td>- Cyclones</td>
<td>- lack of financial resources for sustainable forest management (planting, pruning, thinning and harvesting)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Wind gusts</td>
<td>- xxx</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Floods</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Sea level rise / salt water intrusion</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6.5 Water Sector - Vulnerabilities, Sensitivity and Adaptive Capacities

[needs to be updated by the NACCC and local stakeholders]
The larger mountainous islands of Vanuatu have good ground and surface water resources whilst the low lying islands have limited fresh ground water in shallow aquifers and rely heavily on rainwater. The mountainous terrain also creates challenges for traditional water carriers, the women and children, especially where sources are far from villages.

There is generally abundant rainfall (from <100mm per month in July to >400mm per month in January) although this varies from north to south of the country and high mountainous islands create rain shadows on their leeward side. In 2006 the Northern Islands received 20 to 30 percent more than average rain whilst the Southern Islands received 20 to 40 percent less rain than average.

Flooding and poor farming practices have resulted in erosion, threatening land stability and the health of rivers and marine life in or around river mouths. In general, the islands with active volcanoes have all suffered negative effects on water quality by contamination from a mixture of fluoride, hydrochloric acid, and sulphuric acid. This has created problems for rainwater collection systems and some surface water quality.

Inundation of water resources caused by land subsidence, sea level rise and water extraction is becoming more common. The opinion of the National Disaster Management Office is that “if a village doesn’t have a problem with the quantity of drinkable water it has it will have a problem with the quality of drinking water it has. This is an issue for almost every person living in a rural area.” (National Water Strategy)

Port Vila water supply is provided by UNELCO, a private company under contract with the Government. The water supply for Luganville, Isangel and Lakatoro are managed by the PWD. Water quality is generally good with chlorine used for water treatment in Port Vila and Luganville. There are at least 6 known private water suppliers around Port Vila operating outside the UNELCO concession area. These suppliers are not regulated and no monitoring activity is known.

Outside these areas water supply is either taken from groundwater via open wells and bores, from surface water sources, or rainwater collection with storage in ferro-cement or polyethylene tanks. Demand for irrigated water is extremely low and limited to a few small horticultural sites (National Water Strategy).

The following table is summarizing the current impacts, sensitivities to climate change as well as the current adaptive capacity

<table>
<thead>
<tr>
<th>Sector</th>
<th>Water Impact</th>
<th>Current Sensitivity to Climate Change</th>
<th>Current Adaptive Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>- lack of water storage and distribution infrastructure</td>
<td>- existing rainwater harvesting systems in some communities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- lack of financial resources for infrastructure maintenance</td>
<td>- introduction of a IWRM concept (based on the National Water Strategy)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- lack of potable water caused by contamination</td>
<td>- bottled water available in and around urban centers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- no water monitoring system in place</td>
<td>- xxx</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- no water resource database of the quality, quantity and location of water resources in place</td>
<td></td>
</tr>
</tbody>
</table>
Although Vanuatu’s biodiversity has been widely reported as less rich than its neighboring countries, New Caledonia and Solomon Islands, recent studies have suggested that Vanuatu’s biodiversity was in fact richer than was previously estimated (Environment Unit, 1999). Vanuatu is in fact an important faunal crossroad in the Pacific. The three main streams by which it is believed wildlife colonized the SW Pacific (Papuan, Australian and Polynesian), meet here.

Of all the islands in Vanuatu, Espiritu Santo has the greatest species richness with 49 native species of land and freshwater birds found here. This represents 75% of Vanuatu’s native land and freshwater birds and 85% of land and freshwater birds that breed in Vanuatu. Seven of the eleven species of bats found in Vanuatu are also present in the Santo region (Nari et al, 1996). Vanuatu’s 200 nautical miles exclusive economic zone is extensive and encompasses mangrove, sea grass, lagoon, coral and pelagic habitats. Mangroves, sea grass and other coastal ecosystems provide protective buffers that shelter land and human settlements from the full impact of storm events but are under pressure from subsistence and commercial land use. (FAO, 2007)

The following table is summarizing the current impacts, sensitivities to climate change as well as the current adaptive capacity.
7. Overview of Adaptation Options

7.1 Identification of Adaptation Options

Based on the assessment of sector vulnerabilities a list of adaptation options was identified in a two-step participatory consultation process. These adaptation options may be justified by considering the risks of climate change, and even without considering these risks. In addition, in the interest of generating as full a catalogue as possible of adaptation options, these options were initially generated without regard to their feasibility, cost, or other limiting factors. These criteria have been included into the analysis in another step in which the adaptation measures have been evaluated (see chapter 10).

Adaptation options can be designed to provide net benefits regardless of climate change (these are known as “no regrets” or “low regrets” measures) or can, on the other hand, depend on projections of changes in climate to justify their benefits (known as “climate justified” measures).

“No regrets” or “low regrets” adaptations are justified under current (or historical) climate and are even more justified when climate change is taken into account. No regrets adaptations include removing or limiting maladaptation. Investments in development, particularly those that enhance the capacity of a society to adapt to climate change, are “no regrets” adaptations. The category also includes other measures, such as reduced pollution and destruction of natural habitats, water conservation and enhanced public health systems. Indeed, promoting development makes sense anyway and will reduce the vulnerability of future societies to climate change.

**Examples of “No regrets” and “low regrets” adaptation measures from the annex**

- NCCAS Strategy # 38 Forestry – Plant local, endemic and long-cyclone resistant species
- NCCAS Strategy # 4 Agriculture – Practice fruit drying

“Climate justified” adaptations consist of measures taken specifically to anticipate climate change. Often these are changes made to long-lived investments. For example, a sea wall being built or rehabilitated might be built somewhat higher to account for sealevel rise.

**Examples of “climate justified” adaptation measures from the annex**

- NCCAS Strategy # 155 Forestry – Implement irrigation systems of commercial properties
- NCCAS Strategy # 173 Livestock – Design bullock pastures so that streams and other water courses pass through them
“Climate justified” adaptations can be changes to infrastructure design, but can also include changing land use (such as limiting development in areas that would be vulnerable to climate change), enhancing emergency response procedures, enabling standards to be updated on the basis of changed conditions, and so on. Here, information on how climate may change may be needed to alter infrastructure design, land-use decisions, or other long-term decisions. In implementing such “climate justified” actions, however, adequate consideration needs to be placed not only on the projected climatic changes but also on the uncertainties associated with such projections. As noted in Section 5, all climate projections are subject to uncertainties. Even when uncertainties are large it is still important to make decisions to reduce unacceptably large climate-related risks. In such circumstances it is important to focus on no regrets initiatives. Such initiatives are towards the left of the continuum of climate change response initiatives (Figure 8).

Figure 8. Examples of responses to climate change, from development focussed (left) to climate change focussed (right), with examples for adaptation, mitigation and the two combined. Adapted from McGray et al. (2007) and OECD (2009).

7.2 Building on Existing Coping Strategies

Rural communities in Vanuatu have a long history of responding to climate variability and change, but with varying levels of success. These short-term coping strategies form the basis of successful long-term adaptation strategies. However, care needs to be taken as some of these traditional coping strategies could prove to be unsustainable over time as climate change progresses, leading to a greater risk of maladaptation. For example, short-term adaptation strategies in response to a decrease in rainfall could include over-exploitation of groundwater resources, which could actually exacerbate vulnerability over the longer term. Innovative approaches and new technologies and monitoring of the effectiveness of strategies in light of changing circumstances are needed to make sure that coping and adaptation strategies remain appropriate. Rural communities are therefore the key actors for implementing adaptation strategies, and hard-won lessons can be learned, communicated and fed into adaptation decision making at higher levels.

Box 4

EXAMPLES OF CURRENT COPING STRATEGIES IN VANUATU

[Include examples for traditional coping strategies in land based resource management]
7.3 Overview of Adaptation Options

The following box is summarizing some of the more than 500 adaptation measures which have been derived from stakeholder consultations. The full list is included into Part 2 of this strategy.

Box 5
EXAMPLES OF ADDITIONAL ADAPTATION OPTIONS BASED ON THE NCCAS ANNEX

[Include examples for additional adaptation strategies from the annex]

7.4 Limits to Adaptation on Sectoral and Local Level

The NCCAS outlines climate change adaptation measures on sectoral and local level that are practical and applicable in the political, social and economic framework of
Vanuatu. However the implementation of adaptation actions on sectoral level is generally facing a number of key challenges that need to be dealt with:

**Awareness:** Awareness about climate risks is important to help sectors and communities deal with current climate variability and change. Lack of awareness on the part of government authorities, educators and trainers represents a significant impediment to integrating climate change considerations at local decision-making levels.

**Information:**
- **Sector Level:** Unlike the national level where assessments of climate change impacts and vulnerabilities are generally available, there is a general lack of detailed information on climate change impacts, vulnerabilities, and adaptation priorities at the sectoral level. Furthermore, there is also a need for assessments on how climate change impacts might interplay with other drivers of change within the context of specific sectors. For example, in the case of the agricultural sector, the implications of climate change might need to be viewed not in isolation from but in conjunction with other pressures such as demographic trends, scenarios of water availability, and trends in trade and commodity prices – all of which might influence sectoral policies. Such integrated information would often be key to both partner governments and donors to facilitate more meaningful integration of adaptation at the sectoral level. Chapter 9 provides additional information on how two or more sectors might deal with this challenge.
- **Local Level:** Perhaps the most challenging information gap on local level is the availability of climate change projections at a scale that is relevant to rural communities. Efforts to downscale global and regional climate models proceed, but their utility at the community level is still limited. General trends can provide a starting point for considering changing risks, but may not be enough to encourage behavioural change. The absence of climate change projections however is no justification for doing nothing but should be taken into consideration in the long term.

**Priorities:**
- **Sector Level:** Adaptation to climate change is still not high enough on the agenda of some sectoral ministries and donor agencies in Vanuatu and beyond. Even in cases where consideration of climate variability is part of established practice (as in water resource management), the established regulations and procedures frequently rely upon historical climate as a baseline and do not adequately reflect how the baseline itself might change as a result of the changing climate.
- **Local Level:** Climate change adaptation is competing with other development priorities such as HIV/AIDS, conflict and access to primary education. In rural communities, because managing climate risk may be viewed as a “way of life”, local authorities may be reluctant to allocate too many resources to it. Instead, they may want to focus on more immediate threats to development such as infectious diseases, illiteracy, and food insecurity. The key to making sure climate risk management and climate change considerations do not remain ignored is to make the links between these development priorities and climate risk. For example, climate risk management may have an important role to play in reducing disease transmission and food insecurity.

**Capacities**
• **Sector Level:** There is a general lack of capacity in terms of analysing the implications of climate change in many sectors. There is also limited access to centralised sources of climate expertise such as the Meteorological Services. Consequently, decision makers may not have adequate information on the specific implications of climate change on their specific sectors.

• **Local Level:** Local governments and organisations are almost always underresourced and over-committed. Budgets are typically stretched, whether local government revenue is raised locally or allocated by central government. Technical knowledge in the area of climate risk is correspondingly limited, as hydro meteorological knowledge is typically housed in a small department of a ministry, often removed from local communities. These inadequacies reflect local governments lacking the resources to meet their responsibilities – and often with very limited capacities to invest (as almost all local revenues go to recurrent expenditures or debt repayment).

**Institutional structures:** Complicated and unresolved institutional questions or conflicts may present a barrier to the implementation of adaptation actions on sector and local level. For example, poorly defined or insecure land tenure may impede a revision of local land-use plans and prevent people from adopting certain resilience-building strategies, since there may be no guaranteed returns on risk reduction investments on the land if land is suddenly taken away. Chapter 9 provides a detailed stocktaking of the current institutional set up and potential measures to strengthen these institutions.
8. Vanuatu Policies & Plans Relevant to Climate Change

The NCCAS aims to support the implementation of existing national and regional strategies and policies, particularly where these define goals and actions that are relevant to climate change adaptation. Aligning the NCCAS with these policies will contribute to increased resilience and adaptive capacity, locally, nationally and regionally. In addition, the NCCAS will focus on areas in which specific adaptation policies, strategies and plans are as yet lacking.

The following national and regional policies and plans have been identified as relevant in the context of the NCCAS and influence climate change adaptation in Vanuatu:

Relevant national policies and strategies:

- *Priorities and Action Agenda (PAA) 2006-15*
- *PAA 2006-2010 Supplementary for Mainstreaming Disaster Risk Reduction and Disaster Management*
- *Disaster Risk Reduction and Disaster Management National Action Plan 2006-16*
- *National Adaptation Program for Action (NAPA)*
- *Land Sector Framework 2009-18*
- *National Biodiversity Conservation Strategy*
- *Physical Planning Act of 1986*
- *Environmental Management and Conservation Act No. 12 of 2002*
- *Foreshore Development Act 1976*
- *The Vanuatu and the Secretariat of the Pacific Community Joint Country Strategy 2011-2015*

Policies under development:

- *National Forest Policy*
- *Vanuatu Overarching Productive Sector Policy*
- *Climate Change Policy and Implementation Strategy*

Relevant regional strategies:

- *United Nations Framework Convention on Climate Change*
- *United Nations Convention on Biodiversity*
- *Pacific Island Framework for Action on Climate Change 2006-2015 (PIFACC)*
- *The Pacific Plan for Strengthening Regional Cooperation and Integration*
These policies and initiatives differ in terms of focus, i.e. some are sector-specific policies (e.g. National Forest Policy), while others relate to all sectors within the national economy (e.g. Priorities and Action Agenda). They also vary in terms of their nature and purpose and, as a result, take climate change and its impacts into account to varying degrees — they range from initiatives with broader environmental or sustainability objectives, to climate change initiatives relevant to both mitigation and adaptation, to specific initiatives aimed at improving adaptation, adaptive capacity and disaster risk management.

Regardless of the depth of climate change integration into these policies and strategies, all contain goals and measures that are relevant to, or may contribute to supporting, the adaptation process in Vanuatu. The table below provides an overview of adaptation relevant directives, priorities and measures contained in the aforementioned policy documents.
<table>
<thead>
<tr>
<th>Policy/strategy/legislation</th>
<th>Relevant land-based sectors/resources</th>
<th>Examples of priorities/actions relevant to climate change adaptation</th>
<th>Analysis: Link with NCCAS and contribution to adaptation; synergies and gaps</th>
<th>Legal and implementation status of the policy/strategy/legislation</th>
</tr>
</thead>
</table>
| Priorities and Action Agenda 2006-15 (PAA) | Agriculture | (p. 27) Increased productivity through:  
- Better research on traditional food crops  
- More effective extension services  
- Dissemination of improved planting material  
- Improving access to credit  
- Increased ni-Vanuatu participation in agribusiness | Successful adaptation is a precondition for achieving the goals of the PAA, which is to raise the welfare of the people of Vanuatu, inter alia, through higher and sustainable economic growth. Equally, various priorities defined in the PAA contribute to adaptation in the land-based sectors. Both the NCCAS and the PAA, if implemented effectively and efficiently, can support each other for the benefit of the entire nation. | This section will be completed by local stakeholders; progress in implementation is an important piece of information for the gap analysis in column four, which can only be undertaken once this information has been received |
| Forestry | (p. 28)  
- Improve/increase sustainable management  
- Expansion of agro-forestry  
- Greater utilization of other timber species | | | |
| Livestock | (p. 27) Improved livestock production through:  
- Improved extension services to livestock  
- Better access for smallholder farmers to credit  
- A program of breeding improvement | | | |
| PAA Supplementary for Mainstreaming Disaster Risk Reduction and Disaster Management | All land-based sectors | All policy objectives outlined in Section 4. In particular:  
- recognise disaster risk management as a development issue and mainstream all-hazards risk management into all sectors and decision-making processes at all levels of government, including national planning and budgetary processes  
- recognise disaster risk management as a whole-of-country responsibility and actively engage communities, NGOs and the private sector in disaster risk reduction and disaster management efforts  
- recognise that disaster risk management is | The DRR/DRM NAP and PAA DRR/DRM Supplement were prepared in tandem and jointly define actions to reduce disaster risks in Vanuatu. They call for institutional strengthening through fostering integration of disaster risk reduction in all economic sectors and high-level coordinating responsibility for DRR and DRM (rather than leaving | |
about supporting communities to reduce and manage risks, and empower communities by providing appropriate and timely information; building their capacity to use this information to make informed decisions; and promoting community-based disaster risk management through participatory planning and public-private sector partnerships

In addition, the PAA DRR/DRM Supplement calls for revising the PAA to mainstream DRM (see Annex 1); adaptation-relevant actions include:

(p. 19) Meteorological services to provide timely and accurate meteorological information to facilitate integration of climate change into national development plans. Objectives:

- provide early warning systems
- build local capacity
- incorporate climate change and other risk management issues into national development plans, sector plans, etc.

responsibility with the small, potentially under-funded National Disaster Management Office). Implementation of relevant actions will contribute to improved resilience of people, institutions and resources and enhanced adaptive capacity.

The NCCAS acknowledges a close relationship between DRR/DRM and adaptation, and strengthen the DRR/DRM agenda by identifying relevant actions.

| Disaster Risk Reduction and Disaster Management National Action Plan (NAP) | All land-based sectors | The NAP summarises key strategies and programs contained in various ministerial, sectoral and provincial corporate plans; provision of particular interest to land-based resources include:

(p. 14) Strengthen the Vanuatu Meteorological Service to increase its ability to provide accurate forecasts and forewarning, particularly in light of increased frequency and intensity of extreme weather events

(p. 17) Develop village water supply systems and watershed management, including the provision of training to village dwellers to maintain their own water systems |

| Planning Long, Acting Short: The Land | The following strategies are of particular relevance to climate change adaptation (p. 4): |

If properly implemented, Planning Long, Acting Short
<table>
<thead>
<tr>
<th>Government’s Policy Priorities for 2009-12</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Implement key recommendations of the national land summit especially sustainable utilization of land by Ni-Vanuatu</td>
</tr>
<tr>
<td>• Strengthen Land Laws Act to increase transparency in land lease decisions</td>
</tr>
<tr>
<td>• Strengthen the capacity of the MLNR to formulate and implement land policies and laws</td>
</tr>
<tr>
<td>• Promote sustainable environment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Productive sector, including agriculture, livestock, forestry</th>
</tr>
</thead>
<tbody>
<tr>
<td>(p. 6)</td>
</tr>
<tr>
<td>• Improved productive sector institutional capacities</td>
</tr>
<tr>
<td>• Improve farmers’ access to markets and information</td>
</tr>
<tr>
<td>• Improve access to credit facilities through existing commercial and micro credit schemes</td>
</tr>
<tr>
<td>• Institutional strengthening of DARD, Forestry Extension Services, livestock services</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>National Adaptation Program for Action (NAPA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture &amp; food security, water, agriculture, forestry, land use planning</td>
</tr>
<tr>
<td>Adaptation strategies defined across these sectors and activities, e.g. rainwater harvesting, sustainable livestock farming and management, sustainable forestry management, early warning systems</td>
</tr>
</tbody>
</table>

can create important synergies for adaptation in the land-based resources area; however, the short time-frame of the strategy presents limits to what is achievable and the effectiveness in contributing to adaptation over the longer term. Therefore, it would be useful if synergistic actions were included in any follow-up policy from 2012.

The NAPA focuses on urgent and immediate needs and includes a list of ranked adaptation activities and projects based on individual preferences and information existing at the time. The NCCAS, on the other hand, focuses on the medium to long term and defines priorities for land-based resources based on the most recent data and climate change impact information. Where adaptation measures defined in the NAPA are in line with updated action priorities, their...
<table>
<thead>
<tr>
<th>Land Sector Framework 2009-2018</th>
<th>Land resources management, including agriculture, forestry</th>
<th>Implementation is fully supported by and included within the NCCAS.</th>
</tr>
</thead>
</table>
|                                | All strategies and activities outlined in the Framework are directly or indirectly relevant to adaption, in particular the following (p. 7):  
  - Strengthen land management  
  - Support sustainable development practices  
  - Increase support for community awareness and engagement | While not explicitly mentioning climate change, some strategies defined in the LSF will directly contribute to enhanced adaptation. However, it would be critical for LSF measures (that cut across all important sectors of the economy) to take climate change into account. |
<p>| National Water Strategy 2008-2018 | Water, agriculture, livestock, forestry | All seven objectives of the strategy have the potential to contribute to climate change adaptation if they take the impacts of climate change into account in their implementation. Currently, climate change is not explicitly mentioned in the objectives. |
|                                | The strategy is generally relevant for adaptation as it calls for a sustainable and equitable access to safe water and sanitation for the people of Vanuatu to support improved public health and promote social and economic development. At a high level, it acknowledges that climate-related changes have the potential to exacerbate the situation caused by the growing demand for water, thus potentially further limiting the availability of potable water. | |
| National Biodiversity Conservation Strategy | Biodiversity, water and other land-based resources | The Strategy was adopted in 1999 and there is a potential that some of the priorities specified are outdated. Climate change is not explicitly mentioned in the Strategy. An update of the strategy might be warranted that takes climate change and its impacts into account. |
| Physical Planning Act of 1986 | Potentially agriculture, livestock, forestry, water | The Physical Planning Act primarily regulates the built environment sector and therefore is relevant to land-based sectors such as agriculture, livestock, forestry and water and their related production and processing infrastructure. | Climate change impacts and adaptation are not explicitly taken into account in the Act. To facilitate a built environment more resilient to both future changes in weather and extreme weather events arising from climate change, it would be necessary to identify and implement changes in regulations such as the Physical Planning Act. |
| Environmental Management and Conservation Act No. 12 of 2002. Amendment in 2011. | All land-based resources and sectors | Through setting of environmental standards, making provision for a national environmental registry, and requiring environmental impact assessments (EIA) for all projects in Vanuatu, the Environment Act is potentially of adaptation relevance to all land-based sectors. | The Act and its tools and provisions, such as the EIA and the environmental registry, were considerably strengthened through incorporation of climate change aspects and impacts in a 2011 amendment. |
| Vanuatu and the Secretariat of the Pacific Community Joint Country Strategy 2011-2015 | Agriculture, livestock, forestry, environment | All key result areas defined for relevant land-based sectors indirectly contribute to adaptation. Some key result areas make a direct contribution by explicitly addressing adaptation. These include: Agriculture, key result areas 4, 5, 7, pp. 17 &amp; 18: • Climate change adaptation strategies developed and integrated into national priorities and strategies • New crop varieties introduced and produced, and improved and resilient climate-ready planting materials disseminated • Appropriate databases and information management systems developed to capture | The Vanuatu-SPC JCS aims to support the implementation of the PAA and the Planning Long, Acting Short Action Agenda. As such it contributes indirectly to adaptation by supporting the goals and objectives in defined in both policy documents that are of relevance to adaptation (see above). In addition, the JCS defines some actions that are directly relevant to the adaptation process. |</p>
<table>
<thead>
<tr>
<th>National Forest Policy</th>
<th>Forestry</th>
<th>Objectives and actions that directly address adaptation include those that:</th>
<th>The Vanuatu National Forest Policy has recently been revised and updated. This opportunity was used to fully integrate climate change into four thematic areas. As such, once adopted by the Government, the National Forest Policy is one of the most progressive policies in the country and makes an important contribution to the implementation of forestry-related actions defined in the NCCAS.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>• contribute to adaptation, e.g. biodiversity conservation (see section 4H&amp;L), watershed management and soil conservation (see section 4D)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• directly address climate change adaptation (see section 4J)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• will be improved by taking adaptation into account, e.g. actions relating to extension (4Z), land use and land use planning (4F)</td>
<td></td>
</tr>
<tr>
<td>Vanuatu Overarching Productive Sector Policy</td>
<td>Agriculture, livestock, forestry</td>
<td>To be finalised in 2011, currently only the ‘Report on Consultations during 12-30 July 2010’ is available</td>
<td>The Productive Sector Policy will be an important policy affecting, in particular, the agriculture, livestock and forestry sectors, and will need to take climate change into account in order to be effective and efficient. This has also been raised in the consultations and the consultation report emphasizes: “The competing demands on the environment...”</td>
</tr>
</tbody>
</table>
and differentiated impacts of climate change must be assessed and taken into consideration when formulating strategies to address the development challenges the productive sector faces."

| Draft CC Policy and Implementation Strategy | All land-based resources and sectors | This Policy exists only in draft form and is unlikely to be adopted and implemented in its current form. |  |  |  |  |  |  |  |  |
Since the NCCAS is designed to support and contribute to Vanuatu’s medium-to-long-term development goals, it aims to support implementation of the goals and priorities of existing policies wherever possible, rather than identifying and implementing new ones. This is an important way to maximise synergies and avoid duplication, thus avoiding or reducing confusion of actors and inefficient use of existing institutional and financial resources.

Importantly, when developing strategies and actions under the NCCAS care has been taken to ensure that they are in line with the latest scientific findings. This is particularly important in cases where the current policies are likely to be outdated in terms of climate risks, and how best to manage them. A possible example is the National Biodiversity Conservation Strategy, which dates back to 1999.

On the other hand, most of the above mentioned policies are reasonably up to date. After recent revision some of them now take climate change into account explicitly. This is the case with the National Forestry Policy. Other sectors, however, represent current policy gaps, which may be partly filled by the NCCAS. For the important sector of agriculture, for example, no sector policy currently exists.
9. Vanuatu Climate Change Institutional Arrangements

9.1 Institutional capacity: A stocktake

According to the Draft National Capacity Self-Assessment Project Report on the UNFCCC (2006, p. 51), ‘Vanuatu is one of the Pacific Island Countries and LDC that have done enormously well in this aspect of capacity building for implementation of adaptation measures’. In the five years since this assessment, Vanuatu has made significant further progress and is among the leaders in the Pacific region in developing and implementing climate change adaptation and disaster risk reduction and management measures.

A number of reforms and initiatives have contributed to improved governmental and institutional capacity in Vanuatu. An important step has been, for example, Vanuatu’s Comprehensive Reform Program (CRP), which was launched in 1997 as a response to ‘fiscal fragility, political instability, economic stagnation, inefficient public administration and poor social service delivery in the mid to late 1990s’ (Hay, 2009, p. 22). Among other goals, the CRP aimed to renew governance institutions, and develop a redefined role for the public sector and improved public sector efficiency (Proposal for GEF funding for National Capacity Needs Self-Assessment for Global Environmental Management (NCSA), 2004, p. 8).

Ten years on from the launch of the CRP, further reforms have been brought underway through the implementation of the Governance for Growth (GFG) program. This program addresses barriers and impediments to achieving improved economic and social outcomes inherent in current governance and institutional arrangements.

A number of new policies and plans, developed and implemented as a result of these reforms, demonstrate the progress Vanuatu is making in addressing institutional issues that will also improve the capacity to implement climate change adaptation measures. Such initiatives include:

- The Priorities and Action Agenda (PAA) 2005-2016, the Government’s medium-term strategy for development;
- Planning Long, Acting Short: Action Agenda for 2009-2012, which uses the priority areas in the PAA as a starting point to address specific priorities;
- The Disaster Risk Management Framework, including an arrangements flowchart, which was adopted by the government in early 2007 as the basis for developing new legislation, a new disaster management plan and new government organizational arrangements;
- The new Land Reform Policy, which will lead to a five-year action plan that includes land-use zoning maps and vulnerable area mapping, addressing both disaster risk reduction and climate change adaptation.

While there has been significant progress, there is much more that can, and should be, done to foster progress towards a more resilient nation that is less vulnerable to the impacts of climate change. Political, legal, research, social and other institutions will need to be further strengthened.

In the context of implementing appropriate DRR/DRM and climate change adaptation measures, a recent report notes: ‘Success in all of the areas identified by the government will require it to overcome the policy inertia that presently exists and to substantially improve policy implementation’ (Hay, 2009, p. 23).
Other reports emphasize the general lack of coordination between Government departments, limited monitoring and enforcement of relevant regulations, as well as other limitations, including those outlined in Box 1, as a barrier to effective action.

Box 1

OVERVIEW OF KEY ENVIRONMENTAL CAPACITY ISSUES IN THE GOVERNMENT SECTOR

Most Government Departments recognise capacity limitations at the individual or staff level, and emphasise a need to expand on training both to equip staff to better complete their existing responsibilities and to up-skill individuals to better fill the nation’s needs for technical and managerial staff.

Second to this is recognition of inadequate institutional capacity with which to address environmental responsibilities: this includes inadequate work facilities; inadequate budget allocations; inadequate access to technical equipment; inadequate ability to maintain equipment in place; and inadequate information and data management. The Department of Meteorology finds it difficult to keep the increasingly complex technical base necessary to effectively interface with weather monitoring systems deployed in Australia and Fiji. Many agencies have raised issues over sharing and management of information.

Both these priority capacity building needs reflect inadequate resourcing of the environmental sector. This is due in part to the structural economic problems faced by the country and also to government priority being directed toward provision of social services such as education and health, expanding opportunities for income generation and providing an enabling environment for private sector led growth. In comparison the NBSAP Enabling Add-on has led to significant recognition of structural capacity needs, and has been active to build the foundations for an institutional platform that will be better able to support in-country environmental management over the long term.

Note: Despite assessing the broader environmental capacity, these issues are generally also applicable in the context of climate change adaptation. While these capacity limitations will have been addressed and mitigated to some extent since the writing of the GEF proposal, they may nevertheless be considered in implementing the NCCAS.


For an overview of findings of the CCA/DRR Institutional and Policy Analyses for Vanuatu, as of May 2009, see Appendix 1.

9.2 The way forward: Strengthening institutions and governance for adaptation

Any review of institutional arrangements in Vanuatu with a view to strengthening them in support of adaptation to climate change must consider the administrative structure in the country. While the Government of Vanuatu formally makes decisions and operates at national, provincial and municipal levels, there is also a parallel traditional customary structure, which effectively operates at national, island, area and village level. It is important to strengthen adaptive capacity within both administrative structures. However this section primarily describes options for institutional strengthening at the formal government level.

a. Options for governance of climate change adaptation issues at national level

It must be noted that the establishment of the NACCC, which occurred as early as the late 1980s, positioned the country well to deal with climate change. Having an institution with the mandate to advise and act on climate change is a prerequisite for successful management of climate related issues and risks.
However, it appears that to strengthen the country’s capacity to deal with current and future impacts of climate change, some changes to governance structures and responsibilities will be necessary. Options discussed by stakeholders include:

- Maintain the current structure and location of the NACCC but strengthen the body’s capacity and expertise in the area of climate change adaptation and equip it with the financial and human resources necessary to provide decision-makers with robust and relevant information on climate change impacts, vulnerability and adaptation options, and oversee the implementation of the NCCAS;

- Restructure and/or relocate the NACCC, for example:
  - Restructure the NACCC and allow for the formation of Technical or Thematic Working Groups (TWGs) overseen by the NACCC. These TWGs could be formed following the example of the working groups under the Land Sector Framework and include representatives of relevant ministries, municipal councils etc. An ‘Integrated Farming Working Group’ was mentioned as an example, which would include representatives from agriculture, environment, livestock and forestry. These working groups would be responsible for providing advice on and coordinating the adaptation work of the different sectors. Working groups should be appointed by the responsible Minister, be given clear Terms of Reference, be integrated into Public Service Commission job descriptions, be provided an appropriate budget and its performance should be linked to and measured by key performance indicators (KPIs);
  - Relocate the NACCC to be included in the formal structures of either the Ministry of Environment or the Vanuatu Meteorological Service;
  - Amalgamate the NACCC and the National Disaster Management Taskforce, which is responsible for implementing DRR/DRM measures of the NAP (National Action Plan), to exploit synergies between adaptation and DRM policies and measures; and obtain endorsement for this new body by the Council of Ministers.

- Expand the portfolios of existing Ministries to include responsibility for climate change (adaptation), for example:
  - Make climate change adaptation, including coordination of relevant activities and guidance of all sectors, a responsibility of the Prime Minister’s Office (Policy and Planning); placing responsibility for adaptation with an ‘influential ministry’ should be done in acknowledgement of the cross-sectoral nature and significance of adaptation;
  - Include climate change responsibility in the portfolio of the Department of Economic and Sector Planning;
  - Development of KPIs by the Directors General (DGs); the KPIs would reflect the achievement in terms of climate change adaptation in their sectors. Incentives shall be put in place for the different sectors to work together to achieve the KPIs. Stakeholders further suggested that the Public Service Commission (PSC) reviews the DG and staff job descriptions (or, alternatively, puts DGs under contract) and reviews their performance regularly;

- Form a new Ministry or Department responsible for climate change:
Form a new ‘Department of Climate Change’, which could sit, for instance, within either the Ministry of Lands or the Ministry of Public Utilities. (Some stakeholders warned, however, that forming a separate ministry for climate change could be counterproductive if it just adds another layer of bureaucracy without leading to much improvement in the take up of climate change issues by the different sectors.)

Form a Ministry of Natural Sciences, which would be responsible for climate change, water, energy and other relevant topics.

While the large number of options suggested by stakeholders reflects the divergent visions of Vanuatu’s climate change institutional environment, there are also significant commonalities. All stakeholders agree that the new institutional arrangement should reflect that climate change is a development issue, not just an environmental issue. As a result, responsibility for climate change should be established at a high level in government with decision-making power.

Further actions to strengthen governance arrangements and institutions may include, but are not limited to, the following:

- **Mainstreaming of adaptation**: It is recommended that the process of mainstreaming climate change adaptation into sectoral policies, strategies, plans and programmes be continued, and that the necessary resources be made available. In this context, stakeholders have suggested that the PAA be reviewed with a view to improving the ‘visibility’ of climate change and DRR/DRM, and that the review result in practical actions towards these goals.

- **Modify adaptation funding arrangements**: In the first instance, the Ministry of Finance and Economic Management, and other bodies with budgetary decision-making power, should become involved in, and share responsibility for, adequately responding to climate change and support the effective and efficient implementation of the NCCAS. Then, in order to make the implementation of adaptation more effective and efficient, stakeholders suggested that the Finance Department screen all sectoral budgets, business plans and proposal to ensure climate change adaptation has been taken into account and, where that is the case, distribute funding according to the needs (recommended to follow OECD climate lens guidelines for budget processes, see Box 2).

- **Due to the cross-sectoral nature of adaptation**, it is also important to strengthen cooperation between different sectors and to reduce competition for funds. Stakeholders mentioned joint programming as particularly effective in implementing activities through shared responsibility and effective allocation of resources.

**Box 2

APPLYING A CLIMATE LENS TO PROPOSED SECTORAL PLANS AND RESOURCE ALLOCATION**

A climate lens should be applied to the proposed sectoral plans to assess climate risks and/or opportunities and potential responses. An important measure may be to revise existing guidelines and criteria used to assess plans proposed by sectoral ministries, with a view to adding climate change concerns. The application of a climate lens to proposed sectoral plans should lead to better
("climate-proofed") plans or proposals and suggest modifications if required.

The resource allocation stage corresponds to the translation of operational action into budgets. National budgets and, in some countries, Medium Term Expenditure Frameworks (MTEFs⁹) constitute the main instruments at this level. The national budget is spread across the different sectors and thus determines the budget envelope that each sector has to implement in its sector-level development plans. […]

The national budget is the main instrument for operationalising a government’s policy. […] The specific interventions that are required at the resource allocation stage within the national policy cycle would consist of:

Reallocating funding to more vulnerable sectors or regions or increase the budget for these regions: The climate lens should reveal key sectors and regions that will be vulnerable to climate change and which may require further funding to “climate-proof” their policies/programs and also develop specific adaptation responses/measures/programs/projects. The results from this climate lens can therefore serve to reorient to a certain extent some of the funding to more vulnerable sectors or regions, or lead to an increase in budget for some sectors and regions.

Funding for adaptation specific plans or activities: Funding adaptation may entail: (i) funding nation-wide plans specifically aimed at enabling adaptation (e.g. investment in new agricultural technologies such as more drought-resistant varieties); (ii) establishing a horizontal fund for adaptation which sectoral ministries could tap on to meet the additional costs of integrating identified climate risks in their planned activities or investments.

The MTEF process can be used to incorporate adaptation priorities into resource allocation processes. The MTEF may need to be reviewed to determine if climate change adaptation priorities have been appropriately integrated into medium-term spending plans.

The following figure provides an overview of the main interventions for climate change adaptation at the national policy cycle.

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⁹ Medium-term expenditure frameworks are a budget programming tool for planning actions and programming spending over a three to five year period, thereby translating policies into budgets.
Strengthening of other important ministries and services: For example, adaptive capacity within the Ministry of Land and Natural Resources will need to be strengthened in order to ensure that land policies, laws and management practices take climate change risks and impacts into account. In addition, the Vanuatu Meteorological Service (VMS) should be strengthened through an increase in human and financial resources (see also Box 3).
Box 3
CAPACITY BUILDING ISSUES FOR IMPLEMENTING THE UNFCCC: RESEARCH AND SYSTEMATIC OBSERVATION

Systematic observations including meteorological, hydrological and climatological services have been very, very good in Vanuatu especially at the VMS. As an important component in the overall monitoring of climate and weather conditions, the VMS has data dating back more than five (5) decades. What has been lacking is the analytical aspect of these variables i.e. temperatures, humidity, rainfall etc against research hypothesis. Research as a tool for decision making has never been given the recognition and resources although most government departments have research sections and even the formation of a national scientific research council (NSRC) has not improved the status of research capacity and capability in the country.

[...] research using the relevant systematic observation meteorological, hydrological and climatological data must be promoted to:

- Better understand the effects of the present climate, (climate variability) on human health, agricultural production, marine resources in order to better understand and predict the implications of climate change;
- Develop situational analysis of real potential impacts on Vanuatu’s vulnerable populations (vulnerability);
- Facilitate early detection of future socio-economic effects (health, food production, food security, economic loss etc) of climate change; and
- Facilitate the formulation of relevant socio-economic development policy (Evidence-based policy and evidence-based decision making) in the context of global warming and global environmental change (adaptation and mitigation strategies).


b. Develop new and make better use of existing policies, laws, regulations and processes

Apart from strengthening Ministries and other government bodies, it will also be important to establish new policies, laws and processes or strengthen existing ones in order to facilitate adaptation, such as:

- Develop and implement a national climate change policy: According to stakeholders, it is important to update and adopt the existing climate change policy, or develop a new national policy for climate change. Such a policy could follow the example of the Land Sector Framework as a multi-sectoral overarching policy and set broad goals and objectives and a road map for action. Implementation would occur in the different sectors and be included in the respective sector plans.
- Strengthen the EIA process: Strengthening the Environmental Impact Assessment (EIA) instrument to become a ‘two-way process’ could contribute to improved adaptation. Apart from explicitly addressing climate change risks through this process by identifying those activities that will potentially exacerbate the risks posed by climate change or lead to mal-adaptation, good practice would also mean an EIA is used to determine the impact of climate change on the proposed initiative. Stakeholders have further recommended that EIAs be made a requirement before granting major loans for a development activity (preferably as voluntary best practice by the bank).
- Use regulations to facilitate adaptation by private actors: Enhanced adaptive capacity may also occur through increasing the understanding of how laws

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10 Malaysia’s Vision 2020 or PNG’s or Samoa’s visions could also be used as a model in implementing the policy.
and legal institutions, including regulatory instruments, support or impede adaptation planning and practice. Where barriers exist, institutional reforms could be undertaken in order to reduce or remove existing obstacles and facilitate adaptation, particularly by private actors. In this context, it is recommended to also assess the potential for, and limits to, market-based adaptation measures. This may include a review of the role of the financial sector, particularly insurers and banks, in enabling climate change adaptation.

- Awareness raising and education: All ministries in Vanuatu and their staff should be made aware of the implications of climate change on the resources they are directly responsible for and other resources more widely; this includes training on the use of the new climate change information and database systems\(^{11}\). In addition, a public awareness campaign should be designed to inform the general public about existing and expected climate changes and impacts, as well as practical examples of successful adaptation measures. This campaign should be based around strong leaders and advocates and use existing education and awareness raising channels\(^{12}\).

- An initiative to "green the banks", by requesting local financial institutions to agree that when they loan monies, they will encourage people to ensure their development minimizes greenhouse gas emissions (e.g. fund solar), reduces climate risk (e.g. setback from hazard areas) and enables adaptation.

- Undertake continuous monitoring and evaluation of the progress made in reducing vulnerability and increasing resilience in general, and achievement of the NCCAS objectives in particular. In this context, it will be important to revise and enhance data collection, management and sharing arrangements in order to allow for progress to be measured and strategies to be revised where they are not achieving the desired outcomes.

\(^{11}\) Such as those that are currently under development by the Lands Department, the Vanuatu Meteorological Service and SPC-GIZ.

\(^{12}\) Such as the Wan Smolbag's Vanua-Tai monitors approach or the Vanuatu Cultural Center's fieldworker programme.
10. *Action Plans* (5pp)

[This will be prepared after the annexes are completed]

- overview of sector action plans (details in annexes)
- communication and uptake (details in annexes)
- funding (details in annexes)
- monitoring, evaluation and reporting (details in annexes)
12. Recommendations

[These will be inserted for the final draft of the NCCAS]
13. References


**Appendix 1: Summary of Findings of the CCA/DRR Institutional and Policy Analyses for Vanuatu**

<table>
<thead>
<tr>
<th>Level of mainstreaming of DRR in development planning processes</th>
<th>National</th>
<th>Local</th>
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<tbody>
<tr>
<td>Disaster risk management is integrated in the PAA; a key priority and strategy is to prepare a Port Vila development plan which mainstreams climate change and disaster risk reduction measures; the National Disaster Act (2000) focuses primarily on preparedness and response arrangements for disasters; while the Act includes a definition of prevention, it is not specific about requirements and powers for addressing prevention measures.</td>
<td>A key priority and strategy in the PAA is developing and implementing risk reduction programs in communities; Vanuatu is the only Pacific island country recipient of the USD 65.69 million Millennium Challenge Corporation funds which focus on overcoming transport infrastructure constraints to poverty reduction and economic growth, specifically for rural areas.</td>
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<table>
<thead>
<tr>
<th>Level of mainstreaming of CCA in development planning processes</th>
<th>National</th>
<th>Local</th>
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<tr>
<td>Vanuatu’s NAPA was adopted by Government in 2007; this determines eligibility to apply for funding for implementation under the LDC Fund, which is managed by the Global Environmental Facility; Vanuatu has also prepared a discussion paper, Climate Change Policy and Implementation Strategy; its purpose is to provide a summary on climate change development in Vanuatu including future areas that the government and other stakeholders need to address, to determine the issues that had been identified over the years in particular from the First National Communication that may form the basis for a climate change policy, and to develop a preliminary climate change policy framework for consultation purposes; the discussion paper proposes a policy framework that highlights the commitment of government, through the Environment and Meteorology Departments and other government ministries, civil society and the private sector to mainstreaming climate change issues in all its environmental, social, economic, planning structures and processes for sustainable development at the national and community level.</td>
<td>The policy framework also highlights a commitment to proactively identify vulnerable communities, areas and assets at risk and develop adaptation options that are appropriate, cost effective and culturally sensitive in order to increase resilience; there is also a commitment to ensure effective provincial participation in the climate change process, with existing systems being used as the basis for local authority participation.</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Policies and plans for DRR and how they have been translated into programmes</th>
<th>National</th>
<th>Local</th>
</tr>
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<tbody>
<tr>
<td>A number of ministries and agencies participate in disaster risk management, including Vanuatu's Meteorological Department which is responsible for day to day weather forecasting, cyclone and tsunami warnings and advisories, and long term seasonal forecasting; the Agriculture Department is involved in disaster response; the Department of Internal Affairs which coordinates responses between provincial authorities; the National Advisory Committee of Climate Change (NACC) assists in raising awareness on disaster risk reduction through its climate change core team; the Ministry of Lands and Natural Resources incorporates risk reduction into land, water and energy planning; a National Water Strategy Plan has been prepared proposing risk assessments and vulnerability mapping; this work has commenced, but there is very little capacity to undertake it; the biggest impediment to the development of risk and vulnerability assessments and maps is a lack of climatic, hydrological and geophysical data.</td>
<td>Both the NAP and its Implementation Plan include provisions for extending disaster risk management to the provinces; however, lack of funding prevents implementation of the NAP. Provinces are, in theory, also mandated to prepare their own Disaster Plans which should be approved by the NDMO Director, reviewed annually, and updated as needed; but lack of action on the central NAP has prevented the creation of provincial action plans; provincial authorities are responsible for coordinating responses under the guidance of the NDMO and NDC; each village should have a disaster management committee which coordinates response at the local level, works in consultation with the provincial level and is responsible for local level damage and loss assessments; most volunteer organisations or agencies that assist civil society organisations and/or rural communities to implement DRR are involved on a voluntary basis, with this as their secondary activity; their primary focus is on service delivery and technical assistance type of work right across all the provinces of Vanuatu; the situation is improving as a result of the recent expansion of the international &amp; local NGOs like the Red Cross and CARE who engaging communities in participatory methods of problem identification, risk analysis and action planning in Vanuatu; their objective is for communities to be empowered to organise themselves for, and manage, disasters and to build risk reduction measures into their daily development activities;</td>
<td></td>
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<tr>
<th>Policies and plans for CCA and how they have been translated into programmes</th>
<th>National</th>
<th>Local</th>
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<tbody>
<tr>
<td>Vanuatu’s NAPA identifies four priority sector areas:</td>
<td>The main output of the Vanuatu Climate Change Adaptation</td>
<td></td>
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</tbody>
</table>
agriculture and food security, sustainable tourism development, community based marine resource management and sustainable forestry management; the EU announced mid 2008 that the Vanuatu NAPA qualified for funding under its Global Climate Change Alliance, with co-financing by the World Bank totalling VT 800 million; the project, “Enhancing coastal and marine ecosystems resilience to climate change impacts through strengthened coastal governance and conservation measures” is being executed by SPREP; a GIZ project focusing on land based resource management as a means of building resilience to climate change is being executed by the South Pacific Commission and is funded by GIZ to a total of Euro 1.4 million.

Project is a rainwater harvesting project on the island of Aniwa in the southern province of Tafea; the Vanuatu component of the PACC project will focus on climate proofing coastal infrastructure with Epi island as the pilot site.

Institutional arrangements for DRR

National

Disaster risk management is housed in the Ministry of Internal Affairs, which supports the National Task Force (NTF) for Disaster Risk Reduction and Disaster Management; the NTF comprises representatives of departments with a role in disaster risk management and is co-chaired by the Director of the Meteorological Service and the NDMO; the NTF takes a proactive as well as reactive approach – thus it does not meet solely in response to a disaster events; the National Disaster Committee (NDC), established by the National Disaster Act, is tasked with developing the country’s disaster risk reduction policy and strategy; it is made up of representatives of relevant government agencies and three NGO representatives; the National Disaster Management Office is its secretariat; the NDMO is tasked with implementing the strategies and policies of the NDC; however, the NDMO has no powers to require other agencies to act on any identified prevention measures; the NDC coordinates response and recovery activities including coordination with donors.

Institutional arrangements for CCA

National

Climate change activities are coordinated by the NACCC; the NACCC is formally recognized by the Vanuatu’s Council of Ministers to implement a Multilateral Environmental Agreement for the government; NACCC is made up of department heads, including the NDMO Director, and chaired by the Director of Forestry; the Director of the Meteorological Services is co-chair of the National Task Force for Disaster Risk Reduction and Disaster Risk Management; the Climate Change Unit in the Department of Meteorological Services functions as the Secretariat of the NACCC; there is a plan for the NACCC to establish a National Group of Experts to do research on environmental change issues, particularly on climate change, affecting the country and periodically report to the NACCC on its findings.

Level of integration of DRR/CCA policies and institutions, incl. drivers and barriers

National

The NTF for DRR and DM is co-chaired by the Director of the Meteorological Service (who has overall responsibility for the governments climate change activities) and the NDMO Director; a key priority and strategy in the PAA is to prepare a Port Vila development plan which mainstreams climate change and disaster risk reduction measures; lack of understanding of climate change and variability issues and DRR in the higher echelons of governance is still a major constraint leading to a lack of coordinated approach to addressing climate related risks; financial and human constraints are a major concern to line departments such as both Meteorology and Environment that are dealing with climate related issues and at present have depended largely on donor assistance to fund on-going activities at the national and community level.

<table>
<thead>
<tr>
<th>Strategy No</th>
<th>Major Impact</th>
<th>Sector</th>
<th>Sector Impact</th>
<th>Adaptation Strategy Specific</th>
<th>Notes, Examples, Recommendations, Advice</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cyclone</td>
<td>Agriculture</td>
<td>Crops are killed</td>
<td>After a cyclone, pile tubers and fresh foods in a hole, the foods will begin to rot, but moisture will eventually drain out and the dried foods can be eaten</td>
<td>practiced in Big Bay Santo</td>
</tr>
<tr>
<td>2</td>
<td>Cyclone</td>
<td>Agriculture</td>
<td>Crops are killed</td>
<td>After a cyclone, bring Fiji taro to bush kitchen, keep in a dry place, and constantly rotate so that is does not constantly lay on one side</td>
<td>can last for months</td>
</tr>
<tr>
<td>3</td>
<td>Cyclone</td>
<td>Agriculture</td>
<td>Crops are killed</td>
<td>dry</td>
<td>Yams can last for many months. (e.g. Uripiv island)</td>
</tr>
<tr>
<td>4</td>
<td>Cyclone</td>
<td>Agriculture</td>
<td>Crops are killed</td>
<td>Practice fruit drying</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>Cyclone</td>
<td>Agriculture</td>
<td>Crops are killed</td>
<td>Practice preserve/jam making</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Cyclone</td>
<td>Agriculture</td>
<td>Crops are killed</td>
<td>Dry nangai and natapoa for long term usage</td>
<td>Big Bay Santo</td>
</tr>
<tr>
<td>7</td>
<td>Cyclone</td>
<td>Agriculture</td>
<td>Crops are killed</td>
<td>Dry breadfruit for long term use</td>
<td>Banks and Torres</td>
</tr>
<tr>
<td>8</td>
<td>Cyclone</td>
<td>Agriculture</td>
<td>Crops are killed</td>
<td>Produce flour for long term use</td>
<td>Manioic- Paunangisu</td>
</tr>
<tr>
<td>9</td>
<td>Cyclone</td>
<td>Agriculture</td>
<td>Crops are killed</td>
<td>Collect wild tubers for consumption after cyclones</td>
<td>Examples of bush tubers from Santo, Erromango and Tanna</td>
</tr>
<tr>
<td>10</td>
<td>Cyclone</td>
<td>Agriculture</td>
<td>Salt Spray will damage crops</td>
<td>Utilize Salt Resistant Crops</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>Cyclone</td>
<td>Agriculture</td>
<td>Salt Spray will damage crops</td>
<td>Protect gardens by building physical ocean barriers etc.</td>
<td>not especially effective with sea level rise projections</td>
</tr>
<tr>
<td>12</td>
<td>Cyclone</td>
<td>Agriculture</td>
<td>Wind physically damages crops</td>
<td>Plant gardens within forest wind breaks, or plant windbreaks to protect sensitive crops (glyricidia)</td>
<td>the coastal strip should not be used for anything but recreation/gathering etc. No gardening, residence building or clearing to protect against storm surge etc</td>
</tr>
<tr>
<td>13</td>
<td>Cyclone</td>
<td>Agriculture</td>
<td>Wind physically damages crops</td>
<td>Avoidance of agricultural activities in the immediate coastal strip</td>
<td>-</td>
</tr>
<tr>
<td>14</td>
<td>Cyclone</td>
<td>Agriculture</td>
<td>Wind physically damages crops</td>
<td>Plant leafy crops in gardens that are well sheltered from winds (e.g. valleys etc)</td>
<td>-</td>
</tr>
<tr>
<td>15</td>
<td>Cyclone</td>
<td>Agriculture</td>
<td>Wind physically damages crops</td>
<td>Plant root crops in exposed areas</td>
<td>-</td>
</tr>
<tr>
<td>16</td>
<td>Cyclone</td>
<td>Agriculture</td>
<td>Wind physically damages crops</td>
<td>Cut the leaves of bananas prior to a cyclone to prevent uprooting</td>
<td>-</td>
</tr>
<tr>
<td>17</td>
<td>Cyclone</td>
<td>Agriculture</td>
<td>Wind physically damages crops</td>
<td>Cut the stems of manioc prior to a cyclone to prevent uprooting</td>
<td>-</td>
</tr>
<tr>
<td>18</td>
<td>Cyclone</td>
<td>Agriculture</td>
<td>Wind physically damages crops</td>
<td>Introduce Dwarf Varieties of manioc that will be less susceptible to wind damage</td>
<td>-</td>
</tr>
<tr>
<td>19</td>
<td>Cyclone</td>
<td>Agriculture</td>
<td>Wind physically damages crops</td>
<td>Remove yam stakes during pre cyclone preparations</td>
<td>-</td>
</tr>
<tr>
<td>20</td>
<td>Cyclone</td>
<td>Agriculture</td>
<td>Wind physically damages crops</td>
<td>Utilize early harvest varieties of yam (6 months) that can be harvested before cyclone season</td>
<td>-</td>
</tr>
<tr>
<td>21</td>
<td>Cyclone</td>
<td>Environment</td>
<td>Direct damage to ecosystems or flora and fauna</td>
<td>Physically remove any creeping vines or invasives that threaten to colonize a damaged forest</td>
<td>In Vathe Santo they use environmentally benign chemicals (not affect other plants via spraying, but use injection) – 5 different trials completed: Weed Master best; and hand cutting works to slow growth but will require ongoing maintenance)</td>
</tr>
<tr>
<td>22</td>
<td>Cyclone</td>
<td>Environment</td>
<td>Direct damage to ecosystems or flora and fauna</td>
<td>Pick up fallen/injured birds and animals and look after them until they are able to be released again</td>
<td>-</td>
</tr>
<tr>
<td>23</td>
<td>Cyclone</td>
<td>Environment</td>
<td>Direct damage to ecosystems or flora and fauna</td>
<td>Provide wild animals with fallen fruits</td>
<td>e.g. fruit bats and flying foxes will be searching for available foods.</td>
</tr>
<tr>
<td>24</td>
<td>Cyclone</td>
<td>Forestry</td>
<td>Change in wood properties and timber quality (twisting, compacting etc)</td>
<td>Employ and train stakeholders on wood technologies to correct timber defects</td>
<td>-</td>
</tr>
<tr>
<td>25</td>
<td>Cyclone</td>
<td>Forestry</td>
<td>Change in wood properties and timber quality (twisting, compacting etc)</td>
<td>Find markets for deformed products</td>
<td>clocks, carvings, furniture etc.</td>
</tr>
<tr>
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<tr>
<td>26</td>
<td>Cyclone</td>
<td>Forestry</td>
<td>Change in wood properties and timber quality (twisting, compacting etc)</td>
<td>Develop guidelines and training on the utilization of durable and lesser known species for construction</td>
<td>-</td>
</tr>
<tr>
<td>27</td>
<td>Cyclone</td>
<td>Forestry</td>
<td>Damage to planted forests (wind damage, breakage, topping)</td>
<td>Practice pollarding/topping to enhance for wind resistance in key species</td>
<td>This technique works well with young natapoa</td>
</tr>
<tr>
<td>28</td>
<td>Cyclone</td>
<td>Forestry</td>
<td>Damage to planted forests (wind damage, breakage, topping)</td>
<td>Prune and thin planted forests before a cyclone</td>
<td>-</td>
</tr>
<tr>
<td>29</td>
<td>Cyclone</td>
<td>Forestry</td>
<td>Damage to planted forests (wind damage, breakage, topping)</td>
<td>Prop young trees with braces to enhance wind resistance</td>
<td>-</td>
</tr>
<tr>
<td>30</td>
<td>Cyclone</td>
<td>Forestry</td>
<td>Damage to planted forests (wind damage, breakage, topping)</td>
<td>Establish green belts/wind breaks around and within planted forests</td>
<td>Casuarina sp work well as windbreaks</td>
</tr>
<tr>
<td>31</td>
<td>Cyclone</td>
<td>Forestry</td>
<td>Damage to planted forests (wind damage, breakage, topping)</td>
<td>Practice proactive management of forests (remove old, dead, diseased species that may cause damage during cyclones</td>
<td>-</td>
</tr>
<tr>
<td>32</td>
<td>Cyclone</td>
<td>Forestry</td>
<td>Damage to planted forests (wind damage, breakage, topping)</td>
<td>Selectively harvest large, cyclone-vulnerable trees and allow small trees to remain.</td>
<td>-</td>
</tr>
<tr>
<td>33</td>
<td>Cyclone</td>
<td>Forestry</td>
<td>Damage to planted forests (wind damage, breakage, topping)</td>
<td>Establish seed orchards in cyclone-resistant and secured locations</td>
<td>-</td>
</tr>
<tr>
<td>34</td>
<td>Cyclone</td>
<td>Forestry</td>
<td>Damage to planted forests (wind damage, breakage, topping)</td>
<td>Take out insurance on planted forests and forestry equipment</td>
<td>-</td>
</tr>
<tr>
<td>35</td>
<td>Cyclone</td>
<td>Forestry</td>
<td>Damage to planted forests (wind damage, breakage, topping)</td>
<td>Identify and plant dwarf fruit trees</td>
<td>-</td>
</tr>
<tr>
<td>36</td>
<td>Cyclone</td>
<td>Forestry</td>
<td>Damage to planted forests (wind damage, breakage, topping)</td>
<td>Identify and encourage plantation establishment in areas less affected by cyclones</td>
<td>-</td>
</tr>
<tr>
<td>37</td>
<td>Cyclone</td>
<td>Forestry</td>
<td>Damage to planted forests (wind damage, breakage, topping)</td>
<td>Discourage introduction of foreign tree species with low wind tolerance</td>
<td>-</td>
</tr>
<tr>
<td>38</td>
<td>Cyclone</td>
<td>Forestry</td>
<td>Damage to planted forests (wind damage, breakage, topping)</td>
<td>Plant local, endemic, long-cyclone resistant species</td>
<td>E.g. whitewood</td>
</tr>
<tr>
<td>39</td>
<td>Cyclone</td>
<td>Forestry</td>
<td>Damage to planted forests (wind damage, breakage, topping)</td>
<td>Establish permanent sample plots to investigate the impacts of cyclones of certain forests and tree species</td>
<td>-</td>
</tr>
<tr>
<td>40</td>
<td>Cyclone</td>
<td>Forestry</td>
<td>Damage to planted forests (wind damage, breakage, topping)</td>
<td>Practice enrichment planting in cyclone/storm affected forests</td>
<td>-</td>
</tr>
<tr>
<td>41</td>
<td>Cyclone</td>
<td>Forestry</td>
<td>Damage to planted forests (wind damage, breakage, topping)</td>
<td>Develop plans and products that utilize (re use) cyclone-damaged trees and branches</td>
<td>-</td>
</tr>
<tr>
<td>42</td>
<td>Cyclone</td>
<td>Livestock</td>
<td>Animals are Killed</td>
<td>Freeze Excess meat where possible</td>
<td>-</td>
</tr>
<tr>
<td>43</td>
<td>Cyclone</td>
<td>Livestock</td>
<td>Animals are Killed</td>
<td>Preserve Meat using traditional bamboo cooking methods</td>
<td>Bullock meat can be preserved by slightly cooking (removing blood), and then baking inside a bamboo tube (the softest/weakest kind of bamboo). The tube must be hung in a dry place, and continuously re-heated. The preserved bullock meat can last for several weeks up to a month.</td>
</tr>
<tr>
<td>44</td>
<td>Cyclone</td>
<td>Livestock</td>
<td>Animals are Killed</td>
<td>Preserve Meat using salting methods</td>
<td>Bullock meat can be preserved by salting. Heavily salted and dry meat is packaged into an airtight container and can last for up to a month.</td>
</tr>
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<tr>
<td>45</td>
<td>Cyclone</td>
<td>Livestock</td>
<td>Animals are Killed</td>
<td>Preserve Fish using multiple canning methods</td>
<td>Can be preserved in sterilized jars using chilli, oil, curry, ginger and onion for up to a month</td>
</tr>
<tr>
<td>46</td>
<td>Cyclone</td>
<td>Livestock</td>
<td>Animals are Killed</td>
<td>Preserve Fish using smoking and drying methods</td>
<td>Fish can be smoked which may last up to 3 days</td>
</tr>
<tr>
<td>47</td>
<td>Cyclone</td>
<td>Livestock</td>
<td>Animals are Killed</td>
<td>Preserve Fish using traditional breadfruit leaf baking methods</td>
<td>Freshwater fish may be baked in tightly wrapped breadfruit or laplap leaves and last for up to a week</td>
</tr>
<tr>
<td>48</td>
<td>Cyclone</td>
<td>Livestock</td>
<td>Physical Damage to Animals</td>
<td>Ensure that farmers have at least one area that can be used as a ‘cyclone pasture’ (open with no nearby trees)</td>
<td>During cyclones, airborne and falling branches and trees pose a major threat to animals</td>
</tr>
<tr>
<td>49</td>
<td>Cyclone</td>
<td>Livestock</td>
<td>Physical Damage to Animals</td>
<td>Farmer should have or make arrangements to have access to multiple pastures/grazing sites that will each be appropriate for a different climate situation</td>
<td>Not overly affected by exposure to strong winds, thus there is no need to bring the animals inside shelters or other structures</td>
</tr>
<tr>
<td>50</td>
<td>Cyclone</td>
<td>Livestock</td>
<td>Physical Damage to Animals</td>
<td>Follow storm warnings/advisories to move herd to safe locations (out of wind)</td>
<td>For example, on Pentecost- farmers bring their herds down from exposed hillsides into the sheltered valleys below</td>
</tr>
<tr>
<td>51</td>
<td>Cyclone</td>
<td>Livestock</td>
<td>Physical Damage to Animals</td>
<td>Avoid fastening animals with ropes to fixed objects during cyclones</td>
<td>-</td>
</tr>
<tr>
<td>52</td>
<td>Cyclone</td>
<td>Livestock</td>
<td>Physical Damage to Animals</td>
<td>Keep smaller animals inside a strong enclosure during cyclones</td>
<td>-</td>
</tr>
<tr>
<td>53</td>
<td>Cyclone</td>
<td>Livestock</td>
<td>Physical Damage to Animals</td>
<td>Allow larger animals to roam free to find adequate shelter during a cyclone</td>
<td>-</td>
</tr>
<tr>
<td>54</td>
<td>Cyclone</td>
<td>Livestock</td>
<td>Physical Damage to Animals</td>
<td>Keep animals out of/ remove animals from known swampy or low lying coastal areas in preparation for a cyclone</td>
<td>-</td>
</tr>
<tr>
<td>55</td>
<td>Cyclone</td>
<td>Livestock</td>
<td>Physical Damage to Infrastructure</td>
<td>Thoroughly inspect all bullock fencing before a cyclone to cut out any living branches on posts (i.e. purao fences)</td>
<td>Strong winds will catch the branches and then begin to root out the fence posts</td>
</tr>
<tr>
<td>56</td>
<td>Cyclone</td>
<td>Livestock</td>
<td>Physical Damage to Infrastructure</td>
<td>Avoid corrosive fencing materials (i.e. barb wire)</td>
<td>An example of major pasture and fence damage by salt can be seen at VLD</td>
</tr>
<tr>
<td>57</td>
<td>Cyclone</td>
<td>Livestock</td>
<td>Physical Damage to Infrastructure</td>
<td>Allow glycine to grow over barbed wire fences to provide a physical barrier to salt exposure</td>
<td>-</td>
</tr>
<tr>
<td>58</td>
<td>Cyclone</td>
<td>Livestock</td>
<td>Salt Spray will damage pastures</td>
<td>Plant less susceptible grasses like Glycine, Signal, Guinea and Koronea grasses which may be affected by salt for 2-3 weeks after the storm, but then will recover.</td>
<td>If the pasture fences are located very near the sea (and less than 50-100meters), there is a high chance that salt-spray will impact (corrode) the barb wire and the kill the pasture grass during major storms and winds</td>
</tr>
<tr>
<td>59</td>
<td>Cyclone</td>
<td>Livestock</td>
<td>Salt Spray will damage pastures</td>
<td>Plant wind breaks near pastures that are coastal, already salt tolerant species</td>
<td>The Department has tried several windbreak species (purao, pine, cylindrica) but nothing yet has been able to quell the impacts of salt spray</td>
</tr>
<tr>
<td>60</td>
<td>Cyclone</td>
<td>Water</td>
<td>Overflowing creeks/rivers damage some piping infrastructure</td>
<td>Raise/elevate river creek crossings highly</td>
<td>-</td>
</tr>
<tr>
<td>61</td>
<td>Cyclone</td>
<td>Water</td>
<td>Overflowing creeks/rivers damage some piping infrastructure</td>
<td>Bury/lower river/creek crossings well underground</td>
<td>-</td>
</tr>
<tr>
<td>62</td>
<td>Cyclone</td>
<td>Water</td>
<td>Overflowing creeks/rivers damage some piping infrastructure</td>
<td>If possible, have water pipes cross rivers/creeks at less vulnerable points up or down stream</td>
<td>Even if not a direct piping course</td>
</tr>
<tr>
<td>63</td>
<td>Cyclone</td>
<td>Water</td>
<td>Overflowing creeks/rivers damage some piping infrastructure</td>
<td>Use local knowledge of cyclone vulnerable areas when laying water pipes/infrastructure</td>
<td>In Futuna regarding land slide problems, serious damage to water infrastructure could have been avoided if engineers had followed local guidance</td>
</tr>
<tr>
<td>64</td>
<td>Cyclone</td>
<td>Water</td>
<td>Sediments and Debris contaminate water supply</td>
<td>Use spring boxes around sources , to ensure nothing gets into the source itself</td>
<td>-</td>
</tr>
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<tr>
<td>65</td>
<td>Cyclone</td>
<td>Water</td>
<td>Sediments and Debris contaminate water supply</td>
<td>Close down inlets to water into tanks before a storm, reopen after event</td>
<td>-</td>
</tr>
<tr>
<td>66</td>
<td>Cyclone</td>
<td>Water</td>
<td>Sediments and Debris contaminate water supply</td>
<td>Ensure there is enough water storage for use during and after the storm events</td>
<td>-</td>
</tr>
<tr>
<td>67</td>
<td>Cyclone</td>
<td>Water</td>
<td>Sediments and Debris contaminate water supply</td>
<td>Practice regular water monitoring</td>
<td>An accurate system must advise when to drink from a possibly contaminated water source or when to wait. Need a PH logger inside the water sources as an indicator</td>
</tr>
<tr>
<td>68</td>
<td>Cyclone</td>
<td>Water</td>
<td>Sediments and Debris contaminate water supply</td>
<td>Ensure the manhole in ferro cement tanks is fitted perfectly to avoid ash fall or other contaminants entering the tanks</td>
<td>On Tanna the tank hole covers do not fit, and debris is able to wash into the tank</td>
</tr>
<tr>
<td>69</td>
<td>Cyclone</td>
<td>Water</td>
<td>Sediments and Debris contaminate water supply</td>
<td>Do not glue in the downpipe of the tank, must be able to pull out as needed before storms</td>
<td>-</td>
</tr>
<tr>
<td>70</td>
<td>Cyclone</td>
<td>Water</td>
<td>Sediments and Debris contaminate water supply</td>
<td>Rain water tanks should use a T joint (first flush system) so that all contaminants are flushed away before water is collected</td>
<td>-</td>
</tr>
<tr>
<td>71</td>
<td>Cyclone</td>
<td>Water</td>
<td>Sediments and Debris contaminate water supply</td>
<td>Close off water sources before a cyclone events to prevent flooding, contamination, especially to crop irrigation areas</td>
<td>-</td>
</tr>
<tr>
<td>72</td>
<td>Cyclone</td>
<td>Water</td>
<td>Sediments and Debris contaminate water supply</td>
<td>Use sediment filtration boxes to purify water</td>
<td>On Pentecost- Ranwati school- built 3 sediment filtration boxes, successful, not too expensive 100,000VT for the whole system built with plywood and cement</td>
</tr>
<tr>
<td>73</td>
<td>Cyclone</td>
<td>Water</td>
<td>Sediments and Debris contaminate water supply</td>
<td>Use slow sand filters for the best filtration of contaminated water</td>
<td>Slow sand filters may be effective, however need a very large filter for a good flow of water (community size)</td>
</tr>
<tr>
<td>74</td>
<td>Cyclone</td>
<td>Water</td>
<td>Sediments and Debris contaminate water supply</td>
<td>Design the simplest water filtration systems for Vanuatu sustainability</td>
<td>Systems will require training and maintenance, which is already a problem here for simpler in Vanuatu systems</td>
</tr>
<tr>
<td>75</td>
<td>Cyclone</td>
<td>Water</td>
<td>Sediments and Debris contaminate water supply</td>
<td>Boil water to kill microorganisms and may also reduce this bad ‘tank’ taste</td>
<td>Rainwater tanks may provide water that is not as tasty as those used to drinking from fresh springs etc</td>
</tr>
<tr>
<td>76</td>
<td>Cyclone</td>
<td>Water</td>
<td>Sediments and Debris contaminate water supply</td>
<td>Do not rely on a single source of water; have several backups</td>
<td>May be expensive unfeasible for communities/household to have both piped supply AND rainwater tanks</td>
</tr>
<tr>
<td>77</td>
<td>Cyclone</td>
<td>Water</td>
<td>Sediments and Debris contaminate water supply</td>
<td>Undertake monitoring of water sources after cyclone, to target assistance</td>
<td>-</td>
</tr>
<tr>
<td>78</td>
<td>Cyclone</td>
<td>Water</td>
<td>Sediments and Debris contaminate water supply</td>
<td>Encourage self sufficiency and self help and local disaster response</td>
<td>-</td>
</tr>
<tr>
<td>79</td>
<td>Cyclone</td>
<td>Water</td>
<td>Sediments and Debris contaminate water supply</td>
<td>Mainstreaming hazard assessment and risk management into the current plans and policies</td>
<td>Water safety planning and IWRM</td>
</tr>
<tr>
<td>80</td>
<td>Cyclone</td>
<td>Water</td>
<td>Water sources are destroyed directly</td>
<td>User change technical designs of sources to be cyclone proofed</td>
<td>New designs are now available, changed in 2000, better for high wind, including suggested materials to build tanks etc</td>
</tr>
<tr>
<td>81</td>
<td>Cyclone</td>
<td>Water</td>
<td>Water sources are destroyed directly</td>
<td>Ensure that tank catchment roofs are securely fastened before a storm</td>
<td>Often water tank withstands the winds, but catchment roofing is lost</td>
</tr>
<tr>
<td>82</td>
<td>Cyclone</td>
<td>Water</td>
<td>Water sources are destroyed directly</td>
<td>Small dams &amp; spring boxes may be used so the source itself is not buried</td>
<td>-</td>
</tr>
<tr>
<td>83</td>
<td>Cyclone</td>
<td>Water</td>
<td>Water sources are destroyed directly</td>
<td>Adjust the design of the intake box</td>
<td>G&amp;M may be beginning a trial on Malo, but no national design has been validated yet</td>
</tr>
<tr>
<td>84</td>
<td>Cyclone</td>
<td>Water</td>
<td>Water sources are destroyed directly</td>
<td>Promote underground tanks that are not susceptible to winds</td>
<td>-</td>
</tr>
<tr>
<td>85</td>
<td>Cyclone</td>
<td>Water</td>
<td>Water sources are destroyed directly</td>
<td>Use strong ferro cement tanks that will not move in wind</td>
<td>May be vulnerable to tree and debris damage</td>
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<tr>
<td>86</td>
<td>Cyclone</td>
<td>Water</td>
<td>Water sources are destroyed directly</td>
<td>Do not use light plastic polytanks in cyclone exposed areas polytanks</td>
<td>-</td>
</tr>
<tr>
<td>87</td>
<td>Cyclone</td>
<td>Water</td>
<td>Water sources are destroyed directly</td>
<td>Keep water source areas cleared, cut old branches and remove possible debris to protect infrastructure</td>
<td>-</td>
</tr>
<tr>
<td>88</td>
<td>Cyclone</td>
<td>Water</td>
<td>Water sources are destroyed directly</td>
<td>Build sea walls/other barriers around exposed coastal spring sources</td>
<td>Matantas- storm surge permanently damaged coastal source</td>
</tr>
<tr>
<td>89</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops are exposed to excessive sunlight</td>
<td>Intercrop with valuable trees</td>
<td>With too much sun, crops/fruits are not yet mature but the crop leaves/fruits dry and dies</td>
</tr>
<tr>
<td>90</td>
<td>Drought</td>
<td>Agriculture</td>
<td>sunlight</td>
<td>Intercrop taro with trees that will provide some sunlight penetration</td>
<td>Note: taro requires good sunlight to thrive</td>
</tr>
<tr>
<td>91</td>
<td>Drought</td>
<td>Agriculture</td>
<td>sunlight</td>
<td>Intercrop kumala with banana to provide shade</td>
<td>Intercrop kumala with banana to provide shade</td>
</tr>
<tr>
<td>92</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops are exposed to excessive sunlight</td>
<td>Intercrop trees with banana to provide shade</td>
<td>-</td>
</tr>
<tr>
<td>93</td>
<td>Drought</td>
<td>Agriculture</td>
<td>sunlight</td>
<td>Practice alley cropping with nutrient providing trees like glyricidia</td>
<td>Appropriate for most crops inc: Taro, manioc, kumala</td>
</tr>
<tr>
<td>94</td>
<td>Drought</td>
<td>Agriculture</td>
<td>sunlight</td>
<td>Plant taro under green net (60-80% sunlight) shade cloth</td>
<td>likely very expensive</td>
</tr>
<tr>
<td>95</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops are exposed to excessive sunlight</td>
<td>Use live staking of yam leaves, so that the live supports will provide shade to the yam plant</td>
<td>-</td>
</tr>
<tr>
<td>96</td>
<td>Drought</td>
<td>Agriculture</td>
<td>sunlight</td>
<td>Grow sensitive crops in protected nurseries</td>
<td>-</td>
</tr>
<tr>
<td>97</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Use mulching around crops to trap moisture</td>
<td>Appropriate for most crops inc: Taro, manioc</td>
</tr>
<tr>
<td>98</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Use compost around crops to trap moisture</td>
<td>-</td>
</tr>
<tr>
<td>99</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Rotate crops inside disused livestock pastures to take advantage of manure fertilizers</td>
<td>-</td>
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<tr>
<td>100</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Place manure on and around the stems of crops</td>
<td>-</td>
</tr>
<tr>
<td>101</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Utilize mucuna and other crops to cover and replenish soils</td>
<td>Appropriate for most crops inc: Taro, manioc</td>
</tr>
<tr>
<td>102</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Use cover crops for at least 3 years on degraded soil before planting dry land taro</td>
<td>Cover crops should be used for at least 3 years on degraded soil before planting dry land taro</td>
</tr>
<tr>
<td>103</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Practice minimum tillage of soils before planting, which will hold soil moisture and nutrients</td>
<td>-</td>
</tr>
<tr>
<td>104</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Plant heat and sun tolerant varieties of Taro like navia and taro with small leaves, and leaves pointed down away from the sun.</td>
<td>-</td>
</tr>
<tr>
<td>105</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Select for manioc varieties with smaller leaves and those that grow shorter</td>
<td>-</td>
</tr>
<tr>
<td>106</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Select for manioc varieties that are drought resilient</td>
<td>W. Coast Manioc or some used in custom, which are drought resistant, although these can be quite strong to grate and tougher to eat when cooked.</td>
</tr>
<tr>
<td>107</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Select for yam varieties that produce minisetts (small tubers that do not easily rot or dry out)</td>
<td>-</td>
</tr>
<tr>
<td>108</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Encourage the domestication of wild yam varieties that are climate resistant</td>
<td>-</td>
</tr>
<tr>
<td>109</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Utilize drought resistant varieties of island cabbage (e.g. red vein cabbage, not white).</td>
<td>-</td>
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</tbody>
</table>

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<thead>
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<tbody>
<tr>
<td>110</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Encourage more planting of Vietnam/Chinese Banana as a hardy and drought resilient variety</td>
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<tr>
<td>111</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Select drought and sun resistant vegetables (e.g. beans, white bun/Chinese cabbage, lettuce, tomatoes, pumpkin, capsicum, cucumber, spring onions)</td>
<td>-</td>
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<tr>
<td>112</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Use grafting techniques resilient varieties</td>
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<tr>
<td>113</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Practice targeted irrigation around the roots of the crop may be cost intensive. Appropriate for most crops incl: Taro, manioc especially el Niño event forecasts</td>
<td>-</td>
</tr>
<tr>
<td>114</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Irrigate individual high value plants, with bucket or other means</td>
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<tr>
<td>115</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Irrigate individual high value plants, with bucket or other means</td>
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<tr>
<td>116</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Be conscious of the timing for planting of Taro before drought plant 5-6 month Taro that will be ready for harvest and immune to the dry season.</td>
<td>-</td>
</tr>
<tr>
<td>117</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Follow and act on Meteo climate advisories: el Niño la Niña</td>
<td>-</td>
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<tr>
<td>118</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Plant yams before the onset of a major drought event Yam is usually resistant to water shortage but must be already in ground when drought begins</td>
<td>-</td>
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<tr>
<td>119</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Plant island cabbage every 2 months to ensure that seasonality will not affect all plants at all stages of cabbage growth</td>
<td>-</td>
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<tr>
<td>120</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Relocate garden site to more moist/shaded area The fruit is not yet mature but the banana dries and dies as if were time for harvest</td>
<td>-</td>
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<tr>
<td>121</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Allow several years of garden fallow before replanting in the same area</td>
<td>-</td>
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<tr>
<td>122</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Use permaculture in order to continuously protect soils from excessive drying and overheating</td>
<td>-</td>
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<tr>
<td>123</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Do not burn gardens as cleaning methods, rather weed and leave grass as a mulch to hold soil moisture and nutrients</td>
<td>-</td>
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<tr>
<td>124</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Avoid Garden clearing or maintenance to allow moisture retention</td>
<td>-</td>
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<tr>
<td>125</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Use multiple farming systems (mulching, alley cropping, mix planting etc)</td>
<td>-</td>
</tr>
<tr>
<td>126</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Plant water sensitive/needy plants around water giving plants like nangalat and banana</td>
<td>-</td>
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<tr>
<td>127</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops do not have sufficient water</td>
<td>Remove all but two young banana shoots away from the mother tree and replant in a different area (to relieve water stress during dry seasons)</td>
<td>-</td>
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<tr>
<td>128</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops experience die off</td>
<td>Preserve Taro suckers in household nurseries</td>
<td>-</td>
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<tr>
<td>129</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops experience die off</td>
<td>Collect taro seeds and sow to encourage new varieties, maintain biodiversity, and find climate resistant strains.</td>
<td>-</td>
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<tr>
<td>130</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops experience die off</td>
<td>Practice Tissue Culture in research stations to preserve genetic diversity and climate resilient varieties</td>
<td>-</td>
</tr>
<tr>
<td>131</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops experience die off</td>
<td>Bury planting materials to preserve them during dry and hot times</td>
<td>-</td>
</tr>
<tr>
<td>132</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops experience die off</td>
<td>Utilize store bought/chemicals fertilizers to enhance productivity</td>
<td>-</td>
</tr>
<tr>
<td>133</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops experience die off</td>
<td>Utilize custom fertilizers and manures to enhance productivity</td>
<td>-</td>
</tr>
<tr>
<td>134</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops experience die off</td>
<td>Utilize all parts of vegetables (e.g. pumpkin fruit and leaf tops, sutsut fruit and shoots)</td>
<td>-</td>
</tr>
<tr>
<td>135</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops experience die off</td>
<td>Utilize traditional vegetable crops (ferns or vines)</td>
<td>-</td>
</tr>
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<tr>
<td>136</td>
<td>Drought</td>
<td>Agriculture</td>
<td>Crops experience die off</td>
<td>Take stock of and re-promote traditional foods</td>
<td>Tubers in Erromango, Tanna and Santo that are collected when other tubers die</td>
</tr>
<tr>
<td>137</td>
<td>Drought</td>
<td>Environment</td>
<td>Water in streams and pools becomes stagnant</td>
<td>Introduce freshwater namarai to stagnant pools</td>
<td>Namarai- dig holes in the mud, die when dry. _ the namarai help the flow of water with their digging (aeration). Can be a solution for dead water. Say namarai can pull water</td>
</tr>
<tr>
<td>138</td>
<td>Drought</td>
<td>Environment</td>
<td>Water in streams and pools becomes stagnant</td>
<td>Physically move animals from drying streams to others that are running</td>
<td>use buckets to relocate snails, slugs, naura, freshwater fish</td>
</tr>
<tr>
<td>139</td>
<td>Drought</td>
<td>Environment</td>
<td>Water in streams and pools becomes stagnant</td>
<td>Channel water from consistent source for sensitive animals in drying pools</td>
<td>Freshwater Fish eggs may dry out when rivers are dry</td>
</tr>
<tr>
<td>140</td>
<td>Drought</td>
<td>Environment</td>
<td>Water in streams and pools becomes stagnant</td>
<td>Clean water sources of debris/obstruction to allow flow of water to drying aquatic habitats</td>
<td>-</td>
</tr>
<tr>
<td>141</td>
<td>Drought</td>
<td>Environment</td>
<td>Water in streams and pools becomes stagnant</td>
<td>Build water storage areas (dams etc) for vulnerable species</td>
<td>-</td>
</tr>
<tr>
<td>142</td>
<td>Drought</td>
<td>Environment</td>
<td>Water in streams and pools becomes stagnant</td>
<td>Establish protected areas/tabus to control other threats to drought stressed animals and plants</td>
<td>often protected areas are too small to adequately protect these flora and fauna</td>
</tr>
<tr>
<td>143</td>
<td>Drought</td>
<td>Forestry</td>
<td>Change in timing of fruiting seasons</td>
<td>Utilize green houses for enhanced/controlled fruit production</td>
<td>Fruit trees may be improved in dry conditions (sweetness and abundance)</td>
</tr>
<tr>
<td>144</td>
<td>Drought</td>
<td>Forestry</td>
<td>Change in timing of fruiting seasons</td>
<td>species</td>
<td>-</td>
</tr>
<tr>
<td>145</td>
<td>Drought</td>
<td>Forestry</td>
<td>Food web, flora association, and symbiotic species disruptions</td>
<td>Undertake ecosystem enrichment planting</td>
<td>-</td>
</tr>
<tr>
<td>146</td>
<td>Drought</td>
<td>Forestry</td>
<td>Food web, flora association, and symbiotic species disruptions</td>
<td>Identify and focus on sensitive/vulnerable ecosystems for management</td>
<td>-</td>
</tr>
<tr>
<td>147</td>
<td>Drought</td>
<td>Forestry</td>
<td>Reduction in germination rates</td>
<td>Undertake artificial germination of important species (nursery)</td>
<td>-</td>
</tr>
<tr>
<td>148</td>
<td>Drought</td>
<td>Forestry</td>
<td>Reduction in germination rates</td>
<td>Collect and store wildings for replanting</td>
<td>-</td>
</tr>
<tr>
<td>149</td>
<td>Drought</td>
<td>Forestry</td>
<td>Tree Death</td>
<td>practice species site selection</td>
<td>e.g. sandalwood on dry sides of islands</td>
</tr>
<tr>
<td>150</td>
<td>Drought</td>
<td>Forestry</td>
<td>Water-catchments and watersheds dry up</td>
<td>Provide awareness on the importance of water catchment areas for water quality</td>
<td>-</td>
</tr>
<tr>
<td>151</td>
<td>Drought</td>
<td>Forestry</td>
<td>Water-catchments and watersheds dry up</td>
<td>Establish protected areas over sensitive water catchments</td>
<td>often communities seek benefits from CA with unrealistic tourism aspirations (E.g. Vathe CA Santo)</td>
</tr>
<tr>
<td>152</td>
<td>Drought</td>
<td>Forestry</td>
<td>Water-catchments and watersheds dry up</td>
<td>Reforest and rehabilitate forests within sensitive watershed and catchment areas</td>
<td>-</td>
</tr>
<tr>
<td>153</td>
<td>Drought</td>
<td>Forestry</td>
<td>Water-catchments and watersheds dry up</td>
<td>Place and enforce buffer zones around streams and water sources</td>
<td>-</td>
</tr>
<tr>
<td>154</td>
<td>Drought</td>
<td>Forestry</td>
<td>Wilting of tree leaves/stems, loss of productivity</td>
<td>Establish site specific water guidelines for each species to ensure planting in right location</td>
<td>-</td>
</tr>
<tr>
<td>155</td>
<td>Drought</td>
<td>Forestry</td>
<td>Wilting of tree leaves/stems, loss of productivity</td>
<td>Implement irrigation systems on commercial properties</td>
<td>-</td>
</tr>
<tr>
<td>156</td>
<td>Drought</td>
<td>Forestry</td>
<td>Wilting of tree leaves/stems, loss of productivity</td>
<td>Irrigate individual high value individual trees, with bucket or other means</td>
<td>-</td>
</tr>
<tr>
<td>157</td>
<td>Drought</td>
<td>Forestry</td>
<td>Wilting of tree leaves/stems, loss of productivity</td>
<td>Introduce desalination/distillation for irrigation in dry coastal communities</td>
<td>-</td>
</tr>
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<tr>
<td>158</td>
<td>Drought</td>
<td>Forestry</td>
<td>Wilting of tree leaves/stems, loss of productivity</td>
<td>Develop and expand water storage facilities/infrastructure (water tanks and reservoirs)</td>
<td></td>
</tr>
<tr>
<td>159</td>
<td>Drought</td>
<td>Forestry</td>
<td>Wilting of tree leaves/stems, loss of productivity</td>
<td>Identify and relocate vulnerable species to wetter locations.</td>
<td>see matrix for forest species</td>
</tr>
<tr>
<td>160</td>
<td>Drought</td>
<td>Livestock</td>
<td>Animals are exposed to excessive sunlight</td>
<td>Plant shade trees around and within bullock and pig pastures/enclosures</td>
<td></td>
</tr>
<tr>
<td>161</td>
<td>Drought</td>
<td>Livestock</td>
<td>Animals are exposed to excessive sunlight</td>
<td>Keep forested/shade/reserve areas within the farm, so that during drought times, animals can be moved into these cooler naturally moist areas</td>
<td></td>
</tr>
<tr>
<td>162</td>
<td>Drought</td>
<td>Livestock</td>
<td>Animals are exposed to excessive sunlight</td>
<td>Bullock may be grazed in the open, but for resting should be brought into forests</td>
<td></td>
</tr>
<tr>
<td>163</td>
<td>Drought</td>
<td>Livestock</td>
<td>Animals are exposed to excessive sunlight</td>
<td>Build special houses for pigs to have an appropriate balance of exposure and shelter</td>
<td>Michelle Furet has built a house for night time, during the day, they run in a paddock (fenced) glycine pasture. Pele Island GIZ project site</td>
</tr>
<tr>
<td>164</td>
<td>Drought</td>
<td>Livestock</td>
<td>Animals are exposed to excessive sunlight</td>
<td>Select shady sites for pig enclosures</td>
<td>Lawrence - use the nambanga roots as good shade areas for pigs</td>
</tr>
<tr>
<td>165</td>
<td>Drought</td>
<td>Livestock</td>
<td>Animals are exposed to excessive sunlight</td>
<td>Provide shade over the chicken fence, either with normal housing roof material or trees.</td>
<td>The shade trees used should also be edible (manioc) .</td>
</tr>
<tr>
<td>166</td>
<td>Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>Provide bullock with bore hole wells within pastures</td>
<td>may be very cost intensive</td>
</tr>
<tr>
<td>167</td>
<td>Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>Provide dishes of water, cement pools inside pig fence</td>
<td>Pigs don’t need as much water as bullock</td>
</tr>
<tr>
<td>168</td>
<td>Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>Provide bullock with water dumps within pastures (Dig trenches to hold water)</td>
<td>E.g. in Elgres, a trench was dug and lined with plastic sheeting, but soon afterwards the bullock entered the trench and broke the plastic</td>
</tr>
<tr>
<td>169</td>
<td>Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>Proactively move animals (bullock, pigs, goats etc) close to rivers, streams and water sources during drought times.</td>
<td></td>
</tr>
<tr>
<td>170</td>
<td>Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>Build cement water catchment pools within the bullock enclosure</td>
<td></td>
</tr>
<tr>
<td>171</td>
<td>Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>Provide water to chickens in dishes inside of the fence</td>
<td></td>
</tr>
<tr>
<td>172</td>
<td>Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>Practice composting inside the chicken fence, to keep soil moisture and also attract food insects</td>
<td></td>
</tr>
<tr>
<td>173</td>
<td>Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>Design bullock pastures so that streams and other water courses pass through them</td>
<td>this may cause environmental concerns downstream and with water quality</td>
</tr>
<tr>
<td>174</td>
<td>Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>Design bullock pastures with appropriate mix of grasses: 70% grass, 30% legume</td>
<td>This ratio depend on stocking rate and water content of grass used</td>
</tr>
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<tr>
<td>175 Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>Utilize gravity feed water systems to bring water into the pasture</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>176 Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>Use Bamboo ‘pipes’ to get water running into farms</td>
<td>Malekula as an example</td>
<td></td>
</tr>
<tr>
<td>177 Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>Use living fences to feed and provide moisture-filled leaves for bullocks during dry times.</td>
<td>E.g. at Klem Hill (Kaltuk, has trialed in his farm), the farmer planted Purao trees along the fence and didn’t cut back the leaves. During a prolonged dry spell the bullock ate the leaves to get water. When the Steers from the ‘dry’ pasture were taken to the abattoir, they were almost same weight as bullock from other farms that had had access to regular water supply. Used on Santo w/a climbing big leaf heavily variegated vine and also the Big Leaf Meremia vine.</td>
<td></td>
</tr>
<tr>
<td>178 Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>Feed chickens with moisture rich Navarra &amp; other fresh foods and fruits (pawpaw, mango nakavika)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>179 Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>Feed pigs with moisture rich foods like banana stem, taro, Navarra, pineapple, watermelon, climbing vines, Meremia big leaf.</td>
<td>Some farmers plant pineapples for pig only</td>
<td></td>
</tr>
<tr>
<td>180 Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>Select drought resistant bullock feed varieties</td>
<td>elephant grass, nail grass and siratro.</td>
<td></td>
</tr>
<tr>
<td>181 Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>Let chickens out of fence during the day to find water, but for sleeping come back inside.</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>182 Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>Allow chickens to drink dew on plants outside of the fence.</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>183 Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>Let pigs go into the coconut plantations and cut Navarra for them there</td>
<td>Let pigs go into the coconut plantations and cut Navarra for them there</td>
<td></td>
</tr>
<tr>
<td>184 Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>Fence of plantations especially for use by pigs</td>
<td>On Tongoa, some landowners fence off plantations specially for pigs. Also Tati Larent.</td>
<td></td>
</tr>
<tr>
<td>185 Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>If domesticating wild pig varieties, ensure they have access to water rest areas</td>
<td>Wild pigs choose rainy wet spots for sleeping etc, and roam widely during drought.</td>
<td></td>
</tr>
<tr>
<td>186 Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>Limit the water consumption of pigs to train them for leaner times</td>
<td>If pigs get used to having water always, during dry times they will face more issues.</td>
<td></td>
</tr>
<tr>
<td>187 Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>During extreme drought farmer should consider reducing his stock (selling animals).</td>
<td>The best time to sell is at a change of seasons (wet-dry).</td>
<td></td>
</tr>
<tr>
<td>188 Drought</td>
<td>Livestock</td>
<td>Animals do not have sufficient drinking water/food</td>
<td>During dry times, the bullocks should be mating, and during the wet productive growing seasons, the animals should be calving.</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>189 Drought</td>
<td>Livestock</td>
<td>Animals suffer shortage of water and decreased productivity</td>
<td>Utilize drought resilient varieties of bullock</td>
<td>Charolais (white)- can moderately tolerate drought. Brahman- is very good for drought (as are the local cross-breeds with Brahman)</td>
<td></td>
</tr>
<tr>
<td>190 Drought</td>
<td>Livestock</td>
<td>Animals suffer shortage of water and decreased productivity</td>
<td>Utilize drought resilient Rasta chickens</td>
<td>Rasta fowls may be resilient (more ventilation)</td>
<td></td>
</tr>
<tr>
<td>191 Drought</td>
<td>Livestock</td>
<td>Animals suffer shortage of water and decreased productivity</td>
<td>Utilize drought resilient African chickens</td>
<td>Santo farmers suggest that African and Yellow Leg are also somewhat drought resistant.</td>
<td></td>
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<tr>
<td>192</td>
<td>Drought</td>
<td>Livestock</td>
<td>Animals suffer shortage of water and decreased productivity</td>
<td>Utilize fast breeding African chickens</td>
<td>The African fowls breed faster than the local one, can out breed and out compete, chicks have a higher survival rate than other varieties. More meat, better. But important not to lose other varieties</td>
</tr>
<tr>
<td>193</td>
<td>Drought</td>
<td>Livestock</td>
<td>Animals suffer shortage of water and decreased productivity</td>
<td>Utilize chickens for meat during drought times rather than other animals</td>
<td>In general chickens seem to fare better than other animals. During drought chickens are more productive, during rain, the pikinini will dies.</td>
</tr>
<tr>
<td>194</td>
<td>Drought</td>
<td>Livestock</td>
<td>Animals suffer shortage of water and decreased productivity</td>
<td>Utilize slim, lean wild chickens for drought times</td>
<td>Domesticated chickens have a larger size and require more water while wild chickens are very thin.</td>
</tr>
<tr>
<td>195</td>
<td>Drought</td>
<td>Livestock</td>
<td>Animals suffer shortage of water and decreased productivity</td>
<td>Domesticate wild chickens for meat but ensure robust fencing</td>
<td>Wild fowl is strong- but easily wanders out of the fence to the bush.</td>
</tr>
<tr>
<td>196</td>
<td>Drought</td>
<td>Livestock</td>
<td>Animals suffer shortage of water and decreased productivity</td>
<td>Utilize drought resilient varieties of pig</td>
<td>Wild and Local breed are best</td>
</tr>
<tr>
<td>197</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>year</td>
<td>-</td>
</tr>
<tr>
<td>198</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>Identify nationally vulnerable areas to water shortage and target these first</td>
<td>e.g. el Niño affects middle bush the most etc</td>
</tr>
<tr>
<td>199</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>Develop national databases of water systems and supplies as a tool for decision making</td>
<td>already developed for tafea malampa sanma</td>
</tr>
<tr>
<td>200</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>Undertake surveys of alternative water sources</td>
<td>-</td>
</tr>
<tr>
<td>201</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>Undertake watershed mapping for land use management and forest maintenance</td>
<td>-</td>
</tr>
<tr>
<td>202</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>Do not rely on a single source of water, use and develop multiple systems</td>
<td>ex at Eton, during drought the use an engine pump for ground water, possible to combine bore hole and gravity feed systems.</td>
</tr>
<tr>
<td>203</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>Fill standby/reservoir tanks during wet times for use during dry times</td>
<td>-</td>
</tr>
<tr>
<td>204</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>Use different sources systems at different types of the year</td>
<td>ground water to rainwater tanks according to weather pattern</td>
</tr>
<tr>
<td>205</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>Physically transport water to vulnerable communities</td>
<td>-</td>
</tr>
<tr>
<td>206</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>Relocate households to less vulnerable areas, villages, islands</td>
<td>People of Aneityum have had to move to Tanna for 4-5 months during drought periods</td>
</tr>
<tr>
<td>207</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>Provide drought early warnings to communities</td>
<td>Currently Meteo gives 3 months outlook for el Niño- dry periods</td>
</tr>
<tr>
<td>208</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>Improve the working relationship between Meteo and Hydrology Departments</td>
<td>Currently Met and Hydrology have shared rain gauges, but need to improve cooperation. In other countries the two departments are joined</td>
</tr>
<tr>
<td>209</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>Improve Dept of Geology and Mines operational budget</td>
<td>Hydrology budget is now very low, need more operational support (with only 100,000vt./month-cant be proactive).</td>
</tr>
<tr>
<td>210</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>Water authorities must put in place water conservation or saving measures &amp; awareness</td>
<td>-</td>
</tr>
<tr>
<td>211</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>Increase tank size</td>
<td>-</td>
</tr>
<tr>
<td>212</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>Increase roof catchment area</td>
<td>-</td>
</tr>
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<tr>
<td>213</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>Improve design standard to weather drought periods</td>
<td>Standard design of water tanks, 5L pp per day, designed for average dry season. Not for extremes. Meant for drinking and cooking only. Standard 50m2 roof, 5000L tank</td>
</tr>
<tr>
<td>214</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>Need to change water storage and use behaviors and past history – through awareness</td>
<td>Note: most people have built tanks already for a long time, but during droughts, these old tanks designs may not be enough</td>
</tr>
<tr>
<td>215</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>Develop standard tank designs for different parts of the country (north south etc)</td>
<td></td>
</tr>
<tr>
<td>216</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>Develop water recommendations according to local contexts</td>
<td>Aniwa, no open water etc, recommend individual household tanks rather than communal ones vs. Mataso- insignificant source, hand pumps, and some tanks, but population there is declining so think about growth projections too.</td>
</tr>
<tr>
<td>217</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>Ensure that direct sunlight does not penetrate water to prevent algal</td>
<td></td>
</tr>
<tr>
<td>218</td>
<td>Drought</td>
<td>Water</td>
<td>Shortage of drinking water</td>
<td>Monitor, and clean sources that have become contaminated during droughts before use again</td>
<td></td>
</tr>
<tr>
<td>219</td>
<td>Fire</td>
<td>Agriculture</td>
<td>Fire burns crops</td>
<td>Create firebreaks between bush and garden areas</td>
<td></td>
</tr>
<tr>
<td>220</td>
<td>Fire</td>
<td>Agriculture</td>
<td>Fire burns crops</td>
<td>Remove unnecessary weeds, dead trees, dry branches and dry organic litter from gardens</td>
<td></td>
</tr>
<tr>
<td>221</td>
<td>Fire</td>
<td>Agriculture</td>
<td>Fire burns crops</td>
<td>Relocate gardens away from fire prone areas</td>
<td></td>
</tr>
<tr>
<td>222</td>
<td>Fire</td>
<td>Agriculture</td>
<td>Fire burns crops</td>
<td>Burn flammable grasses around gardens in the wet season to prevent excessive fuel buildup</td>
<td></td>
</tr>
<tr>
<td>223</td>
<td>Fire</td>
<td>Environment</td>
<td>Death of wild animals</td>
<td>Throw moist plants (green) on the fire to slow and stop if not a strong fire!</td>
<td></td>
</tr>
<tr>
<td>224</td>
<td>Fire</td>
<td>Environment</td>
<td>Death of wild animals</td>
<td>Revive cultural burning of grasslands may have been a cultural practice on many islands</td>
<td></td>
</tr>
<tr>
<td>225</td>
<td>Fire</td>
<td>Environment</td>
<td>Death of wild animals</td>
<td>Ensure that grassland burning is not undertaken in biodiversity rich areas coconut crab, snakes and other ground dwelling organisms especially vulnerable</td>
<td></td>
</tr>
<tr>
<td>226</td>
<td>Fire</td>
<td>Forestry</td>
<td>Increase incidence and severity of forest fires</td>
<td>Utilize firebreaks and windbreaks to prevent to spread of forest fires</td>
<td></td>
</tr>
<tr>
<td>227</td>
<td>Fire</td>
<td>Forestry</td>
<td>Increase incidence and severity of forest fires</td>
<td>Discourage burning activities around forested areas during drought seasons</td>
<td></td>
</tr>
<tr>
<td>228</td>
<td>Fire</td>
<td>Forestry</td>
<td>Increase incidence and severity of forest fires</td>
<td>Practice mix cropping/planting approach to prevent spread of fire</td>
<td></td>
</tr>
<tr>
<td>229</td>
<td>Fire</td>
<td>Forestry</td>
<td>Increase incidence and severity of forest fires</td>
<td>Prescribe burning in sensitive forest areas to reduce dangerous biomass fuel buildup</td>
<td></td>
</tr>
<tr>
<td>230</td>
<td>Fire</td>
<td>Forestry</td>
<td>Increase incidence and severity of forest fires</td>
<td>Regularly weed, clean and maintain woodlots</td>
<td></td>
</tr>
<tr>
<td>231</td>
<td>Fire</td>
<td>Forestry</td>
<td>Increase incidence and severity of forest fires</td>
<td>Ensure that fire fighting equipment is accessible and available</td>
<td></td>
</tr>
<tr>
<td>232</td>
<td>Fire</td>
<td>Forestry</td>
<td>Increase incidence and severity of forest fires</td>
<td>Train forestry stakeholders on fire management and fire fighting</td>
<td></td>
</tr>
<tr>
<td>233</td>
<td>Fire</td>
<td>Forestry</td>
<td>Increase incidence and severity of forest fires</td>
<td>Plant fire resilient species (bamboo and wild thatching cane)</td>
<td></td>
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<tr>
<td>234</td>
<td>Fire</td>
<td>Forestry</td>
<td>Increase incidence and severity of forest fires</td>
<td>Provide awareness to forestry stakeholders and communities on the risks of forest fires</td>
<td>-</td>
</tr>
<tr>
<td>235</td>
<td>Fire</td>
<td>Livestock</td>
<td>Animals are directly affected</td>
<td>Do not allow chickens to roam free and lay eggs in the bush during dry season</td>
<td>Adult chickens may be able to avoid fires, but eggs will be affected, especially those of wild fowl</td>
</tr>
<tr>
<td>236</td>
<td>Fire</td>
<td>Livestock</td>
<td>Infrastructure and Pastures are burned</td>
<td>Use less fire prone grasses including Buffalo Grass</td>
<td>Guinea grass lights very easily.</td>
</tr>
<tr>
<td>237</td>
<td>Fire</td>
<td>Livestock</td>
<td>Infrastructure and Pastures are burned</td>
<td>Use steel or iron for fence posts</td>
<td>-</td>
</tr>
<tr>
<td>238</td>
<td>Fire</td>
<td>Livestock</td>
<td>Infrastructure and Pastures are burned</td>
<td>Use living Fence posts which do not rapidly light</td>
<td>-</td>
</tr>
<tr>
<td>239</td>
<td>Fire</td>
<td>Livestock</td>
<td>Infrastructure and Pastures are burned</td>
<td>Ensure that there is an appropriate number of stock in the pasture to remove potential fire fuel</td>
<td>If the numbers of bullock are few but much food remains, then a potential problem exists with fuel buildup</td>
</tr>
<tr>
<td>240</td>
<td>Fire</td>
<td>Livestock</td>
<td>Infrastructure and Pastures are burned</td>
<td>Use less fire prone grasses including Buffalo Grass</td>
<td>Guinea grass lights very easily.</td>
</tr>
<tr>
<td>241</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are infested/infected by pests and disease</td>
<td>Use pesticides against taro beetle and other insects</td>
<td>-</td>
</tr>
<tr>
<td>242</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are infested/infected by pests and disease</td>
<td>Encourage existing Cultural practices that prevent pests &amp; diseases</td>
<td>e.g. in Torba, before planting, a special bush rope can be buried around the garden 1 month before planting taro. The smell and scent of the rope discourages beetles from invading taro plants</td>
</tr>
<tr>
<td>243</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are infested/infected by pests and disease</td>
<td>Utilize and strengthen regional networks that have experience with locally appropriate pest and disease controls</td>
<td>-</td>
</tr>
<tr>
<td>244</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are infested/infected by pests and disease</td>
<td>Prune excess kumala leaves to control rat damage</td>
<td>-</td>
</tr>
<tr>
<td>245</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are infested/infected by pests and disease</td>
<td>Intercrop multiple plants to control the spread of species-specific pests and diseases</td>
<td>-</td>
</tr>
<tr>
<td>246</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are infested/infected by pests and disease</td>
<td>Treat banana nematode infestations by allowing infested roots to aerate and dry before replanting</td>
<td>-</td>
</tr>
<tr>
<td>247</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are infested/infected by pests and disease</td>
<td>Control rat damage on tuber roots by mixing coconut with leaf of glyricidia (which acts as a rat poison)</td>
<td>-</td>
</tr>
<tr>
<td>248</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are infested/infected by pests and disease</td>
<td>Mix concoctions of plants to create natural pesticides</td>
<td>Tamanu infusion water, chili infusion water, derris root infusion water, glyricidia leaf infusion. Avoid the use of synthetic chemicals for pests, but utilize traditional knowledge listed above</td>
</tr>
<tr>
<td>249</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are infested/infected by pests and disease</td>
<td>Prune excess leaves of kumala and other crops to control rat damage</td>
<td>-</td>
</tr>
<tr>
<td>250</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are infested/infected by pests and disease</td>
<td>Harvest island cabbages regularly to reduce the number of insects that accumulate around plants</td>
<td>Island cabbage seems to be especially vulnerable to insect damage after a storm event (may be due to loss of normal food plants)</td>
</tr>
<tr>
<td>251</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are infested/infected by pests and disease</td>
<td>Remove diseased or pest-affected branches or plants</td>
<td>-</td>
</tr>
<tr>
<td>252</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are infested/infected by pests and disease</td>
<td>To prevent whitefly infestation, select island cabbage plants that are not as leafy</td>
<td>-</td>
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<tr>
<td>253</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are infested/infected by pests and disease</td>
<td>Ensure that imported planting materials (from other islands/locations) are pest and disease free</td>
<td></td>
</tr>
<tr>
<td>254</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are infested/infected by pests and disease</td>
<td>Use fire ashes to prevent insect damage on island cabbage: A. Sprinkle ashes on affected leaves, the leaves will die and the new shoots will be insect free B. Mix ashes with soil before planting island cabbage, acts as an infestation prevention C. Surround the cabbage stems by a ring of ashes</td>
<td></td>
</tr>
<tr>
<td>255</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are infested/infected by pests and disease</td>
<td>Cover fruit bunches (bananas, guava etc) with plastic bags to prevent insect attacks</td>
<td>Insects often attack the fruits before they are mature</td>
</tr>
<tr>
<td>256</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are infested/infected by pests and disease</td>
<td>Physically remove or kill caterpillars or other pests that are found within the garden</td>
<td></td>
</tr>
<tr>
<td>257</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are infested/infected by pests and disease</td>
<td>Plant around times of the year that insects are less likely to outbreak or damage crops</td>
<td></td>
</tr>
<tr>
<td>258</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are infested/infected by pests and disease</td>
<td>Weed grass and maintain gardens to remove plants that could harbor pests and diseases</td>
<td></td>
</tr>
<tr>
<td>259</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are infested/infected by pests and disease</td>
<td>Use grafting techniques resilient varieties</td>
<td>practiced on Malekula with disease resistant cacao</td>
</tr>
<tr>
<td>260</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are killed</td>
<td>Bury harvested cassava to preserve it before consumption</td>
<td></td>
</tr>
<tr>
<td>261</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are killed</td>
<td>Make and Use Manioc Flour for use during wet times</td>
<td></td>
</tr>
<tr>
<td>262</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are killed</td>
<td>Store harvested tubers in a cool dry place to prevent rotting before consumption</td>
<td></td>
</tr>
<tr>
<td>263</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are killed</td>
<td>Collect and sow seeds to encourage genetic diversity and obtain possible climate resistant traits</td>
<td></td>
</tr>
<tr>
<td>264</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are killed</td>
<td>Practice tissue culture in the laboratory</td>
<td></td>
</tr>
<tr>
<td>265</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are killed</td>
<td>Plant several varieties of a single crop in order to continuously select the best and healthiest planting materials</td>
<td></td>
</tr>
<tr>
<td>266</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are killed</td>
<td>Use physical barriers around gardens to prevent wind-dispersing pest intrusions</td>
<td>laplap leaves serve as an effective barrier</td>
</tr>
<tr>
<td>267</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are killed</td>
<td>Prune kumala leaves to encourage growth of tuber</td>
<td>Topping is especially problematic when heavy rains occur after a period of drought</td>
</tr>
<tr>
<td>268</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops are killed</td>
<td>Prop tilting banana stems with Y stakes to prevent toppling</td>
<td></td>
</tr>
<tr>
<td>269</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops become waterlogged and rot in ground</td>
<td>Dig drainage canals in gardens to prevent pooling and flooding in gardens</td>
<td></td>
</tr>
<tr>
<td>270</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops become waterlogged and rot in ground</td>
<td>Practice Mix Cropping of water-sensitive crops with species that utilize lots of water and can help control water logged soils</td>
<td>use species with long Tap roots e.g., Papaya or those that can quickly drink large amounts of water banana</td>
</tr>
<tr>
<td>271</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops become waterlogged and rot in ground</td>
<td>Alley crop water-sensitive species in-between with water-intensive species</td>
<td></td>
</tr>
<tr>
<td>272</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops become waterlogged and rot in ground</td>
<td>Use plastic polybags to plant vegetables that are off the ground and cannot be flooded</td>
<td></td>
</tr>
<tr>
<td>273</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops become waterlogged and rot in ground</td>
<td>Build mounds in gardens and plant with vulnerable root crops to keep them above flood waters</td>
<td></td>
</tr>
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<tr>
<td>274</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops become waterlogged and rot in ground</td>
<td>Plant crops in raised beds to prevent flooding or excess moisture</td>
<td>-</td>
</tr>
<tr>
<td>275</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops become waterlogged and rot in ground</td>
<td>Select well drained garden sites, including porous soils that do not hold water</td>
<td>-</td>
</tr>
<tr>
<td>276</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops become waterlogged and rot in ground</td>
<td>Plant along ridges or on gently sloping areas</td>
<td>-</td>
</tr>
<tr>
<td>277</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops become waterlogged and rot in ground</td>
<td>Avoid planting on flood plains or areas close to streams, creeks and rivers</td>
<td>Runoff, floods and landslides can easily uproot bananas</td>
</tr>
<tr>
<td>278</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops become waterlogged and rot in ground</td>
<td>Plant water tolerant root crops like water taro and soft mud taro</td>
<td>-</td>
</tr>
<tr>
<td>279</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops become waterlogged and rot in ground</td>
<td>Find water tolerant varieties with help from regional and national research institutions</td>
<td>-</td>
</tr>
<tr>
<td>280</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops become waterlogged and rot in ground</td>
<td>Plant bananas in water-prone areas as they grow well with a high level of moisture; good productivity</td>
<td>Roots can rot with excessive moisture</td>
</tr>
<tr>
<td>281</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops become waterlogged and rot in ground</td>
<td>Grow wet tolerant vegetable species (e.g. Susut and cucumber and eggplant)</td>
<td>-</td>
</tr>
<tr>
<td>282</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops become waterlogged and rot in ground</td>
<td>Protect crops and germinants from excessive Rainfall greenhouses</td>
<td>-</td>
</tr>
<tr>
<td>283</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops become waterlogged and rot in ground</td>
<td>Change planting timing according to seasonal climate forecasts, especially la Niña events</td>
<td>-</td>
</tr>
<tr>
<td>284</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Crops become waterlogged and rot in ground</td>
<td>Harvest yams early (at the first sign of leaves turning yellow) so that they will not have a chance to rot in the groups.</td>
<td>-</td>
</tr>
<tr>
<td>285</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Top Soil is eroded</td>
<td>Use contour planting to prevent soil erosion during floods or storms</td>
<td>-</td>
</tr>
<tr>
<td>286</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Top Soil is eroded</td>
<td>Practice minimal tillage agriculture</td>
<td>-</td>
</tr>
<tr>
<td>287</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Top Soil is eroded</td>
<td>Utilize vetiver grasses to hold and prevent topsoil loss from gardens</td>
<td>-</td>
</tr>
<tr>
<td>288</td>
<td>Flooding</td>
<td>Agriculture</td>
<td>Top Soil is eroded</td>
<td>Utilize animal manure to counteract soil nutrient leaching in rainy times</td>
<td>-</td>
</tr>
<tr>
<td>289</td>
<td>Flooding</td>
<td>Environment</td>
<td>Floods wash away sensitive flora and fauna</td>
<td>Establish conserved buffer and creek rehabilitation zones as in Lingarek Malekula creekside reforestation</td>
<td>-</td>
</tr>
<tr>
<td>290</td>
<td>Flooding</td>
<td>Environment</td>
<td>Floods wash away sensitive flora and fauna</td>
<td>Divert flood prone waterways away from sensitive biodiversity breeding areas</td>
<td>fast flowing water can wash away ground nesting birds (namalao etc)</td>
</tr>
<tr>
<td>291</td>
<td>Flooding</td>
<td>Environment</td>
<td>Floods wash away sensitive flora and fauna</td>
<td>Remove the invasive vines that are killing trees and covering the canopy that inhibits water removal/evaporation</td>
<td>-</td>
</tr>
<tr>
<td>292</td>
<td>Flooding</td>
<td>Environment</td>
<td>Floods wash away sensitive flora and fauna</td>
<td>Plant trees and flora that have good root systems to control, slow flood damage</td>
<td>Oak trees as not suitable as river erosion control species, are easily washed away</td>
</tr>
<tr>
<td>293</td>
<td>Flooding</td>
<td>Environment</td>
<td>Loss of endemic species</td>
<td>Identify and assist regeneration of water intolerant flora and fauna species</td>
<td>Sheflera &amp; Capoxilon palm (gene pool tanna and south Santo) Dysolim sp. (young) dead due to excessive moisture</td>
</tr>
<tr>
<td>294</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Change in flowering &amp; fruiting seasons</td>
<td>Introduce and encourage wet tolerant species for seasonally waterlogged or low-lying areas.</td>
<td>-</td>
</tr>
<tr>
<td>295</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Change in flowering &amp; fruiting seasons</td>
<td>Undertake vegetative propagation to encourage rapid fruiting</td>
<td>use of cuttings enables fruit bearing trees to mature and bear faster</td>
</tr>
<tr>
<td>296</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Change in flowering &amp; fruiting seasons</td>
<td>Utilize hormones to induce rooting and flowering out of season</td>
<td>-</td>
</tr>
<tr>
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<tr>
<td>297</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Change in flowering &amp; fruiting seasons</td>
<td>Store seeds for use during low fruiting periods</td>
<td>-</td>
</tr>
<tr>
<td>298</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Change in flowering &amp; fruiting seasons</td>
<td>Assess the fruiting calendars of different species in different climatic areas</td>
<td>-</td>
</tr>
<tr>
<td>299</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Change in flowering &amp; fruiting seasons</td>
<td>Protect of trees from rainfall/elements in green houses</td>
<td>-</td>
</tr>
<tr>
<td>300</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Change in flowering &amp; fruiting seasons</td>
<td>Practice anthropogenic fertilization (by hand) in cases where Rainfallinhibits natural pollination and fertilization</td>
<td>-</td>
</tr>
<tr>
<td>301</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Change in flowering &amp; fruiting seasons</td>
<td>Identify, select and plant varieties that fruit/flower at different times throughout the year</td>
<td>-</td>
</tr>
<tr>
<td>302</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Change in flowering &amp; fruiting seasons</td>
<td>Develop and breed new rain-tolerate tree varieties</td>
<td>-</td>
</tr>
<tr>
<td>303</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Change in flowering &amp; fruiting seasons</td>
<td>Undertake grafting to ensure fruiting under controlled conditions</td>
<td>-</td>
</tr>
<tr>
<td>304</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Increase soil erosion, landslides and nutrient loss</td>
<td>Discourage clearing of vegetation on steep slopes</td>
<td>-</td>
</tr>
<tr>
<td>305</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Logging operations are compromised: erosion in logging area.</td>
<td>Use downed braches as a soil erosion/runoff break (sloped areas)</td>
<td>-</td>
</tr>
<tr>
<td>306</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Logging operations are compromised: erosion in logging area.</td>
<td>Gravel/pave roads in logging areas</td>
<td>-</td>
</tr>
<tr>
<td>307</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Logging operations are compromised: erosion in logging area.</td>
<td>Maintain proper crossings (streams and rivers)</td>
<td>-</td>
</tr>
<tr>
<td>308</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Logging operations are compromised: erosion in logging area.</td>
<td>Introduce sediment catchment devices (leaves/branches or other sediment traps)</td>
<td>-</td>
</tr>
<tr>
<td>309</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Logging operations are compromised: erosion in logging area.</td>
<td>Practice good log stacking and log piling to maintain production quality during wet times</td>
<td>-</td>
</tr>
<tr>
<td>310</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Logging operations are compromised: erosion in logging area.</td>
<td>Use cable logging rather than bulldozers</td>
<td>-</td>
</tr>
<tr>
<td>311</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Logging operations are compromised: erosion in logging area.</td>
<td>Shift forestry operations to dry areas/islands during prolong rainy periods.</td>
<td>-</td>
</tr>
<tr>
<td>312</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Logging operations are compromised: erosion in logging area.</td>
<td>Appropriately zone and spatially plan logging activities within concession areas</td>
<td>consider where to log based on distance to mill and environmental features of terrain and climate/weather patterns</td>
</tr>
<tr>
<td>313</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Logging operations are compromised: erosion in logging area.</td>
<td>Follow and plan operations according to Meteo forecasts and outlooks</td>
<td>-</td>
</tr>
<tr>
<td>314</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Logging operations are compromised: erosion in logging area.</td>
<td>Reduce working hours/tasks during rain times</td>
<td>-</td>
</tr>
<tr>
<td>315</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Logging operations are compromised: erosion in logging area.</td>
<td>Plan for the extra available labor during rain times, to do other jobs and functions</td>
<td>-</td>
</tr>
<tr>
<td>316</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Logging operations are compromised: erosion in logging area.</td>
<td>Expand the use of protective gear and clothing</td>
<td>-</td>
</tr>
<tr>
<td>317</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Logging operations are compromised: erosion in logging area.</td>
<td>Introduce forestry workplace condition standards</td>
<td>-</td>
</tr>
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<tr>
<td>318</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Erosion in logging area, muddy conditions, degraded roads and infrastructure, moisture &amp; rust in equipment, machine idleness and breakdowns, wasted salaries/lost income, forgone timber harvests (economic), safety and health of workers.</td>
<td>Abide by the harvesting strategies outlined in the coupe harvesting plans, permits and logging agreements signed with DoF</td>
<td></td>
</tr>
<tr>
<td>319</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Reduce forest and tree biodiversity</td>
<td>Practice ex situ conservation</td>
<td></td>
</tr>
<tr>
<td>320</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Reduce forest and tree biodiversity</td>
<td>Relocate endemic and species of cultural importance to dryer/non-waterlog areas.</td>
<td></td>
</tr>
<tr>
<td>321</td>
<td>Flooding</td>
<td>Forestry</td>
<td>Reduce forest and tree biodiversity</td>
<td>Practice site-species matching for reforestation/rehabilitation</td>
<td></td>
</tr>
<tr>
<td>322</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animal feed is unavailable or productivity is reduced</td>
<td>Plant pasture grass species that can withstand flood conditions (para and elephant)</td>
<td>Para grass- on the Teouma plain and also in Tagabe copes well with flood conditions. Elephant grass is good for flood</td>
</tr>
<tr>
<td>323</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animal feed is unavailable or productivity is reduced</td>
<td>Plant pasture grass species that can tolerate water (papolo and beans)</td>
<td>Bullock feed varieties that are resistant to excessive moisture: papolo grass, beans etc</td>
</tr>
<tr>
<td>324</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animal feed is unavailable or productivity is reduced</td>
<td>Plant fodder tree species in pastures that tolerate water</td>
<td>Kasis and Glyricidia) can also be used during flood times</td>
</tr>
<tr>
<td>325</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animal feed is unavailable or productivity is reduced</td>
<td>Move bullock to less flood prone areas including hill side grazing areas, and plateaus</td>
<td>may have negative environmental affects</td>
</tr>
<tr>
<td>326</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animal feed is unavailable or productivity is reduced</td>
<td>Make advance arrangements where bullock could be moved in case of flooding in the primary pastures</td>
<td></td>
</tr>
<tr>
<td>327</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animal movement in flooded areas leads to enhanced erosion of topsoil</td>
<td>Remove bullock immediately from erosion-prone flooded areas</td>
<td>A major concern with flooding is that when the ground is wet/soft, and bullock are moving around, they are inadvertently digging the soil, which can be washed away. Further flooding combined with bullock activity can seriously erode an area of topsoil</td>
</tr>
<tr>
<td>328</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animal movement in flooded areas leads to enhanced erosion of topsoil</td>
<td>Keep bullock pastures in grass at all times to hold top soils in place during floods</td>
<td></td>
</tr>
<tr>
<td>329</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animal movement in flooded areas leads to enhanced erosion of topsoil</td>
<td>Control the pooling of water in pasture eroded depressions to combat mosquito breeding</td>
<td></td>
</tr>
<tr>
<td>330</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animal movement in flooded areas leads to enhanced erosion of topsoil</td>
<td>Do not select aggressive Brahman bullock in flood prone areas, as they dig</td>
<td>Brahman have a bad temperament- digs much and contributes to erosion, especially the bulls</td>
</tr>
<tr>
<td>331</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animal movement in flooded areas leads to enhanced erosion of topsoil</td>
<td>Do not select aggressive African fowl in flood prone areas, as they dig</td>
<td>African fowls are more aggressive, especially during feeding, and dig and forage more which may contribute to erosion</td>
</tr>
<tr>
<td>332</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>To combat foot rot on the hooves of bullock, place stones within the paddock to trim the hooves</td>
<td></td>
</tr>
<tr>
<td>333</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>To combat foot rot on the hooves of bullock, wash the animals in the sea, but saltwater treatments take considerable time.</td>
<td></td>
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<tr>
<td>334</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>To treat intestinal complications when Bullock drink standing contaminated flood waters, utilize antibiotics and vaccinations</td>
<td>-</td>
</tr>
<tr>
<td>335</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>To treat intestinal complications when Bullock drink standing contaminated flood waters, move bullock out of flooded pastures to other more suitable areas</td>
<td>-</td>
</tr>
<tr>
<td>336</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>To treat water-related scratches on bullock skin, wash with sea water</td>
<td>-</td>
</tr>
<tr>
<td>337</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>Vaccinate pigs to prevent worm buildup/burden</td>
<td>effective vaccination (Tanna, Epi Malakula) sent by livestock. The farmers appreciate it. Not too expensive for medication. (1 bottle 100ml- all of Vanuatu) 1ml 30 kilo live weight.</td>
</tr>
<tr>
<td>338</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>Prevent spread of horseflies by ensuring new animals are fly free when brought in</td>
<td>Horse flies- (come out with high temps)- Disturbs the feeding regime of the bullock, can loose weight</td>
</tr>
<tr>
<td>339</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>Prevent spread of horseflies by not mixing bullock and horses</td>
<td>-</td>
</tr>
<tr>
<td>340</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>Prevent animal pests using store bought chemicals</td>
<td>NEfate farmer- tried to use mortein, but didn’t work</td>
</tr>
<tr>
<td>341</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>To prevent worm infection don’t cover grasses or overstock pastures</td>
<td>When the grazing is allowed to proceed all the way to the ground, bullock, Overstocking can lead to easy transmission</td>
</tr>
<tr>
<td>342</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>To prevent worm infection, utilize improved pastures with higher growth rates</td>
<td>This will decrease the chances of worm infections from ground level grazing etc.</td>
</tr>
<tr>
<td>343</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>To prevent horse rust put blanket or mat or other cover over horses (or put the animal under a shelter)</td>
<td>horses- skin rust- due moisture rainfall</td>
</tr>
<tr>
<td>344</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>To treat bottle jaw on bullock (lump), undertake an Operation to remove puss</td>
<td>-</td>
</tr>
<tr>
<td>345</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>To treat bottle jaw on bullock (lump), improve diet</td>
<td>due to worms, moisture related</td>
</tr>
<tr>
<td>346</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>bathing)</td>
<td>caused by worms</td>
</tr>
<tr>
<td>347</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>of the fowls to one that is more pristine without a build-up of worm eggs/larvae.</td>
<td>-</td>
</tr>
<tr>
<td>348</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>To treat swollen eyes of chickens, use an infusion of lemon, paracetamol, chili or seawater</td>
<td>-</td>
</tr>
<tr>
<td>349</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>To prevent the spread of mites on chickens, don’t mix different size and age groups</td>
<td>adult chickens tend to have, and can pass mites to younger chickens</td>
</tr>
<tr>
<td>350</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>To prevent the impacts of louse on chickens, allow them to be covered in dust and have access to dusty situations</td>
<td>-</td>
</tr>
<tr>
<td>351</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>to control infections, ensure animals are eating appropriate foods</td>
<td>-</td>
</tr>
<tr>
<td>352</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>To control the spread of disease from sick chickens to others in the pens, remove or quarantine sick animals</td>
<td>Disease travels quickly. Ma pass in the air, food etc</td>
</tr>
<tr>
<td>353</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>Use customary legume leaves to treat disease in chickens</td>
<td>One legume used on Santo, leaves crushed and fed to chickens</td>
</tr>
<tr>
<td>354</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>Promote bullock as animal of choice in flooded pastures</td>
<td>Bullock can be quite tolerant of flood conditions in Vanuatu (e.g. at the Tagabe farm- officers observed that Charolais could still move around and were coping well)</td>
</tr>
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<tr>
<td>355</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>Undertake research on moisture tolerant chicken varieties</td>
<td>Rasta fowl may or may not be appropriate for rainy times, though there may be an adaptive characteristic with its feather type. Not enough research on precip impacts on chickens</td>
</tr>
<tr>
<td>356</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>Ensure small chickens (chicks) have access to elevated, fully dry areas for feeding and laying</td>
<td>Eggs, small chicks will be most affected</td>
</tr>
<tr>
<td>357</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>Plant water absorbing trees around chicken coops</td>
<td>Bamboo works well and also provides an egg laying site and shade</td>
</tr>
<tr>
<td>358</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>Lift the floors of chicken coops, raise enclosure away from ground level to prevent storm floods</td>
<td>Also serves to reduce predation, and adds ventilation</td>
</tr>
<tr>
<td>359</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>Ensure that pig enclosures have some permanently dry space</td>
<td>Enclosures to have a house/roof</td>
</tr>
<tr>
<td>360</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>Build roofing over animal coops and enclosures</td>
<td>Cooling</td>
</tr>
<tr>
<td>361</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>Pig enclosures sites should be selected for well draining porous soil types</td>
<td>Pigs can easily drown in flooded enclosures, especially piglets</td>
</tr>
<tr>
<td>362</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>Do not place pig enclosures in known water channels/runoff areas</td>
<td>-</td>
</tr>
<tr>
<td>363</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>Dig water runoff/drainage channels through flood prone pig enclosures</td>
<td>-</td>
</tr>
<tr>
<td>364</td>
<td>Flooding</td>
<td>Livestock</td>
<td>Animals develop sickness</td>
<td>Regularly move the location of pig enclosures so that excessive mud doesn’t accumulate in their pens</td>
<td>-</td>
</tr>
<tr>
<td>365</td>
<td>Flooding</td>
<td>Water</td>
<td>Air pollution (including volcanic ash) is washed into tanks</td>
<td>Tanks should be conically shaped to avoid catching volcanic ash</td>
<td>Aid post in Taniapa is an ash catchment, ash is constantly washed into tanks</td>
</tr>
<tr>
<td>366</td>
<td>Flooding</td>
<td>Water</td>
<td>Air pollution (including volcanic ash) is washed into tanks</td>
<td>Utilize cement water tanks in areas with volcanic ash to neutralize water pH</td>
<td>Cement tanks actually neutralize some drops in water pH</td>
</tr>
<tr>
<td>367</td>
<td>Flooding</td>
<td>Water</td>
<td>Damage to infrastructure (roads, water tanks/storage facilities- wooden tanks etc)</td>
<td>Ensure proper drainage: outflow needs direction away from infrastructures and towards a safer place</td>
<td>-</td>
</tr>
<tr>
<td>368</td>
<td>Flooding</td>
<td>Water</td>
<td>Damage to infrastructure (roads, water tanks/storage facilities- wooden tanks etc)</td>
<td>Check that hand pumps are properly sealed (at top of bore hole) to prevent contamination and back leakage</td>
<td>-</td>
</tr>
<tr>
<td>369</td>
<td>Flooding</td>
<td>Water</td>
<td>Damage to infrastructure (roads, water tanks/storage facilities- wooden tanks etc)</td>
<td>Fully check the performance of new systems 3 months – 1 yr after construction</td>
<td>May be constrained by budget</td>
</tr>
<tr>
<td>370</td>
<td>Flooding</td>
<td>Water</td>
<td>Damage to infrastructure (roads, water tanks/storage facilities- wooden tanks etc)</td>
<td>Build homes with cement around the base so as to prevent inundation</td>
<td>As in Maskellyphes islands</td>
</tr>
<tr>
<td>371</td>
<td>Flooding</td>
<td>Water</td>
<td>Damage to infrastructure (roads, water tanks/storage facilities- wooden tanks etc)</td>
<td>Build homes that are raised above ground level to prevent household inundation during floods</td>
<td>As in W. C. Santo</td>
</tr>
<tr>
<td>372</td>
<td>Flooding</td>
<td>Water</td>
<td>Damage to infrastructure (roads, water tanks/storage facilities- wooden tanks etc)</td>
<td>Build walls and sea walls to prevent storm surge related flooding</td>
<td>E.g. Urupiv, built walls with stone, but filled cracks with Pandanus/coconut leaves to further cut the power of flowing water</td>
</tr>
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<tr>
<td>373 Flooding</td>
<td>Water</td>
<td>Damage to infrastructure (roads, water tanks/storage facilities- wooden tanks etc)</td>
<td>Develop health guidelines on consumption and contamination by air pollution and ash</td>
<td>No acidity guidelines yet in Vanuatu</td>
<td></td>
</tr>
<tr>
<td>374 Flooding</td>
<td>Water</td>
<td>Decrease in Timber quality (moulding, insufficient drying)</td>
<td>Construct proper timber drying facilities to ensure timber is properly dried during rainy periods</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>375 Flooding</td>
<td>Water</td>
<td>Decrease in Timber quality (moulding, insufficient drying)</td>
<td>Apply chemical treatments for mould</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>376 Flooding</td>
<td>Water</td>
<td>Impacts on Forest Eco-tourism: (declines in tourist numbers, tour activities cancelled, mosquito pests, flu and sickness, infrastructure damage, transport options limited)</td>
<td>Plan and promote forest eco-tourism activities for dryer areas during prolonged rainy periods</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>377 Flooding</td>
<td>Water</td>
<td>Impacts on Forest Eco-tourism: (declines in tourist numbers, tour activities cancelled, mosquito pests, flu and sickness, infrastructure damage, transport options limited)</td>
<td>Design forest tourism activities that are rain-proof (indoor activities- greenhouses and indoor botanical gardens)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>378 Flooding</td>
<td>Water</td>
<td>Impacts on Forest Eco-tourism: (declines in tourist numbers, tour activities cancelled, mosquito pests, flu and sickness, infrastructure damage, transport options limited)</td>
<td>Make personal pesticides available to tourists in mosquito-prevalent areas</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>379 Flooding</td>
<td>Water</td>
<td>Impacts on Forest Eco-tourism: (declines in tourist numbers, tour activities cancelled, mosquito pests, flu and sickness, infrastructure damage, transport options limited)</td>
<td>Construct tourism facilities (bungalows) with durable non-weathering timber species (not likely to rot)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>380 Flooding</td>
<td>Water</td>
<td>Impacts on Forest Eco-tourism: (declines in tourist numbers, tour activities cancelled, mosquito pests, flu and sickness, infrastructure damage, transport options limited)</td>
<td>Advise tourism operators on differing weathering properties of various forest products</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>381 Flooding</td>
<td>Water</td>
<td>Increase soil erosion, landslides and nutrient loss</td>
<td>Discourage burning of grasslands or marginal vegetation that holds soil</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>382 Flooding</td>
<td>Water</td>
<td>Increase soil erosion, landslides and nutrient loss</td>
<td>Practice contour cropping/terracing</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>383 Flooding</td>
<td>Water</td>
<td>Increase soil erosion, landslides and nutrient loss</td>
<td>Encourage rehabilitation of bare land and areas subject to soil erosion. Vetiver grass on Aneityum</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>384 Flooding</td>
<td>Water</td>
<td>Increase soil erosion, landslides and nutrient loss</td>
<td>Utilize site capture crops to quickly revegetate bare slopes e.g. whitewood, namamao, pioneer species</td>
<td>-</td>
<td></td>
</tr>
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<tr>
<td>385</td>
<td>Flooding</td>
<td>Water</td>
<td>Increase soil erosion, landslides and nutrient loss</td>
<td>Utilize cover crops to hold soil</td>
<td>e.g. mucuna</td>
</tr>
<tr>
<td>386</td>
<td>Flooding</td>
<td>Water</td>
<td>Increase soil erosion, landslides and nutrient loss</td>
<td>Utilize barrier crops to trap and prevent sediments from eroding</td>
<td>Vetiver grass on Aneityum</td>
</tr>
<tr>
<td>387</td>
<td>Flooding</td>
<td>Water</td>
<td>Increase soil erosion, landslides and nutrient loss</td>
<td>Plant stabilizing trees on vulnerable slopes to control landslides</td>
<td>Narara is used on W. C. Santo to prevent land slides (custom)</td>
</tr>
<tr>
<td>388</td>
<td>Flooding</td>
<td>Water</td>
<td>Increase soil erosion, landslides and nutrient loss</td>
<td>Utilize Nitrogen fixing crops</td>
<td>e.g. glyricidia, kasis</td>
</tr>
<tr>
<td>389</td>
<td>Flooding</td>
<td>Water</td>
<td>Increased growth of weeds and invasive species</td>
<td>Apply local and imported herbicides (and chemical injections)</td>
<td></td>
</tr>
<tr>
<td>390</td>
<td>Flooding</td>
<td>Water</td>
<td>Increased growth of weeds and invasive species</td>
<td>Physically remove invasive species</td>
<td></td>
</tr>
<tr>
<td>391</td>
<td>Flooding</td>
<td>Water</td>
<td>Increased growth of weeds and invasive species</td>
<td>Introduce biological control of invasives</td>
<td>new rust being imported by Quarantine to control Mile-A-Minute vine</td>
</tr>
<tr>
<td>392</td>
<td>Flooding</td>
<td>Water</td>
<td>Increased growth of weeds and invasive species</td>
<td>Practice regular maintenance, cleaning and weeding of forest plots</td>
<td></td>
</tr>
<tr>
<td>393</td>
<td>Flooding</td>
<td>Water</td>
<td>Outbreaks of timber and forest pests and diseases</td>
<td>Identify and relocate vulnerable species that have high risk of pest and disease attack to dryer areas</td>
<td></td>
</tr>
<tr>
<td>394</td>
<td>Flooding</td>
<td>Water</td>
<td>Outbreaks of timber and forest pests and diseases</td>
<td>Practice mixed species cropping systems to prevent rapid spread of disease</td>
<td></td>
</tr>
<tr>
<td>395</td>
<td>Flooding</td>
<td>Water</td>
<td>Outbreaks of timber and forest pests and diseases</td>
<td>Apply local and imported pesticides and Insecticides</td>
<td>Custom plant used in Matantas Santo to surround citrus trees and treat incidences of 'ring worm'</td>
</tr>
<tr>
<td>396</td>
<td>Flooding</td>
<td>Water</td>
<td>Outbreaks of timber and forest pests and diseases</td>
<td>Introduce biological control measures</td>
<td></td>
</tr>
<tr>
<td>397</td>
<td>Flooding</td>
<td>Water</td>
<td>Outbreaks of timber and forest pests and diseases</td>
<td>Physically remove diseased or dying trees/plants</td>
<td></td>
</tr>
<tr>
<td>398</td>
<td>Flooding</td>
<td>Water</td>
<td>Outbreaks of timber and forest pests and diseases</td>
<td>Conduct research on specific tree pests and diseases</td>
<td></td>
</tr>
<tr>
<td>399</td>
<td>Flooding</td>
<td>Water</td>
<td>Outbreaks of timber and forest pests and diseases</td>
<td>Accurately identify pest and disease agents</td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>Flooding</td>
<td>Water</td>
<td>Toilets over flow and contaminate water resources</td>
<td>Do not utilize sensitive Bush and VIP toilets in flood prone areas</td>
<td>Bush toilets and VIPs pits are vulnerable, although even with significant Rainfall events, the rain filtrates quickly</td>
</tr>
<tr>
<td>401</td>
<td>Flooding</td>
<td>Water</td>
<td>Toilets over flow and contaminate water resources</td>
<td>Do not drink ground water near bush and VIP toilets after flood conditions</td>
<td>Problem occurs when flooding occurs, and standing water exists for a long time (Tanna)</td>
</tr>
<tr>
<td>402</td>
<td>Flooding</td>
<td>Water</td>
<td>Toilets over flow and contaminate water resources</td>
<td>Do not use bush and VIP toilets in areas with undraining clay soils</td>
<td>Holen (Efate)- the rain goes in the pits, and overflows into the yards- very much depends on the soil type and layering</td>
</tr>
<tr>
<td>403</td>
<td>Flooding</td>
<td>Water</td>
<td>Toilets over flow and contaminate water resources</td>
<td>Do not swim or bathe in rivers immediately following a flood event</td>
<td>Tagabe to Blacksands, are on the river bank- can see human waste floating past after rain events</td>
</tr>
<tr>
<td>404</td>
<td>Flooding</td>
<td>Water</td>
<td>Toilets over flow and contaminate water resources</td>
<td>Suggest other types of toilet designs</td>
<td>composting toilets are a good alternative</td>
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<tr>
<td>405</td>
<td>Flooding</td>
<td>Water</td>
<td>Toilets over flow and contaminate water resources</td>
<td>Septic tanks could be placed above ground to avoid flood contamination</td>
<td>-</td>
</tr>
<tr>
<td>406</td>
<td>Flooding</td>
<td>Water</td>
<td>Toilets over flow and contaminate water resources</td>
<td>Develop and follow construction standards for water supply and sanitation, use of toilets in certain areas</td>
<td>Already written, currently being reviewed by Hydrology</td>
</tr>
<tr>
<td>407</td>
<td>Flooding</td>
<td>Water</td>
<td>Toilets over flow and contaminate water resources</td>
<td>Consider toilet location in terms of nearby water sources, and also in terms of soil type, nearness to sensitive areas (coral reefs etc)</td>
<td>for example Maskellines – has very strong soil, so should not use pit toilets</td>
</tr>
<tr>
<td>408</td>
<td>Flooding</td>
<td>Water</td>
<td>Underground wells are contaminated</td>
<td>clean wells immediately after major rains</td>
<td>-</td>
</tr>
<tr>
<td>409</td>
<td>Flooding</td>
<td>Water</td>
<td>Underground wells are contaminated</td>
<td>raise the walls of wells so that rain events do not bring debris into them directly</td>
<td>-</td>
</tr>
<tr>
<td>410</td>
<td>Flooding</td>
<td>Water</td>
<td>Waterlogged and anaerobic soils</td>
<td>Introduce forest plot or area drainage systems</td>
<td>-</td>
</tr>
<tr>
<td>411</td>
<td>Flooding</td>
<td>Water</td>
<td>Waterlogged and anaerobic soils</td>
<td>Plant water tolerant tree species in flood prone areas like coconut, bamboo, purao</td>
<td>-</td>
</tr>
<tr>
<td>412</td>
<td>Flooding</td>
<td>Water</td>
<td>Waterlogged and anaerobic soils</td>
<td>Plan or Relocate forestry operations to typically ‘dry soil’ areas</td>
<td>-</td>
</tr>
<tr>
<td>413</td>
<td>Heat Stress</td>
<td>Agriculture</td>
<td>Crops are exposed to excessive temperatures</td>
<td>Use Open and deep hole planting of Taro, dig a deep hole, place taro inside, do not bury so as to allow air cooling of the growing taro.</td>
<td>-</td>
</tr>
<tr>
<td>414</td>
<td>Heat Stress</td>
<td>Agriculture</td>
<td>Crops are exposed to excessive temperatures</td>
<td>Use low tight staking of yam vines that will not allow excessive drying out</td>
<td>-</td>
</tr>
<tr>
<td>415</td>
<td>Heat Stress</td>
<td>Agriculture</td>
<td>Crops are exposed to excessive temperatures</td>
<td>Bury harvested cassava to preserve it before consumption</td>
<td>-</td>
</tr>
<tr>
<td>416</td>
<td>Heat Stress</td>
<td>Agriculture</td>
<td>Crops are exposed to excessive temperatures</td>
<td>Learn how to make Manioc Flour (Modern &amp; traditional methods) so that harvested tubers can be preserved for extended periods.</td>
<td>-</td>
</tr>
<tr>
<td>417</td>
<td>Heat Stress</td>
<td>Agriculture</td>
<td>Crops are exposed to excessive temperatures</td>
<td>Dig the yam, but leave it in an open hole in well drained dry ground. Cover the hole with coconut leaves. can last for months</td>
<td>-</td>
</tr>
<tr>
<td>418</td>
<td>Heat Stress</td>
<td>Agriculture</td>
<td>Crops are exposed to excessive temperatures</td>
<td>Re Bury harvested taro in well drained/sandy soil. can last for months</td>
<td>-</td>
</tr>
<tr>
<td>419</td>
<td>Heat Stress</td>
<td>Agriculture</td>
<td>Crops are exposed to excessive temperatures</td>
<td>Practice alley cropping, to provide shade to vulnerable crops Glyricidia works well, and provides nutrients. Can tie branches together to provide more shade inside alleys</td>
<td>-</td>
</tr>
<tr>
<td>420</td>
<td>Heat Stress</td>
<td>Agriculture</td>
<td>Crops are exposed to excessive temperatures</td>
<td>Practice temporary alley cropping with taro to avoid harsh sunight Taro has been planted inside alleys, and then removed after hot season finishes</td>
<td>-</td>
</tr>
<tr>
<td>421</td>
<td>Heat Stress</td>
<td>Agriculture</td>
<td>Crops are exposed to excessive temperatures</td>
<td>Practice fallow improvement, individual</td>
<td>-</td>
</tr>
<tr>
<td>422</td>
<td>Heat Stress</td>
<td>Environment</td>
<td>Endemic, rare or endangered species may be lost</td>
<td>Protect all species of endemic freshwater fish</td>
<td>-</td>
</tr>
<tr>
<td>423</td>
<td>Heat Stress</td>
<td>Environment</td>
<td>Endemic, rare or endangered species may be lost</td>
<td>Develop databases of all Vanuatu biodiversity, including vulnerable habitats and food sources E.g. freshwater fish database and butterfly database already begun</td>
<td>-</td>
</tr>
<tr>
<td>424</td>
<td>Heat Stress</td>
<td>Environment</td>
<td>Endemic, rare or endangered species may be lost</td>
<td>Identify and protect all species of heat-sensitive gecko</td>
<td>-</td>
</tr>
<tr>
<td>425</td>
<td>Heat Stress</td>
<td>Environment</td>
<td>Endemic, rare or endangered species may be lost</td>
<td>Identify and replant host tree of sensitive epiphyte, orchids and lizards E.g. in Penaru CA Santo- lives of an endemic lizards are symbiotically linked to an epiphytic plant (fern like)- lives inside the cavity</td>
<td>-</td>
</tr>
<tr>
<td>Strategy No</td>
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<tr>
<td>426</td>
<td>Heat Stress</td>
<td>Environment</td>
<td>Endemic, rare or endangered species may be lost</td>
<td>Identify and protect all species of heat-sensitive insects</td>
<td>some of these may be important agricultural pollinators (native bees)</td>
</tr>
<tr>
<td>427</td>
<td>Heat Stress</td>
<td>Environment</td>
<td>Endemic, rare or endangered species may be lost</td>
<td>Identify and protect all species of heat-sensitive high elevation birds</td>
<td>high elevation birds are especially vulnerable (Santo Mountain Starling and endemic pigeon Ducula bakeri)</td>
</tr>
<tr>
<td>428</td>
<td>Heat Stress</td>
<td>Environment</td>
<td>Endemic, rare or endangered species may be lost</td>
<td>Identify and protect all species of heat-sensitive ground nesting birds</td>
<td>ground incubating birds are especially vulnerable (Namalao)</td>
</tr>
<tr>
<td>429</td>
<td>Heat Stress</td>
<td>Environment</td>
<td>Endemic, rare or endangered species may be lost</td>
<td>Place coconut fronds or other protection over sea turtle nests on the beach to cool them down</td>
<td>Temperature affects the number of males and females of sea turtles that hatch from the nest</td>
</tr>
<tr>
<td>430</td>
<td>Heat Stress</td>
<td>Environment</td>
<td>Endemic, rare or endangered species may be lost</td>
<td>Ensure that in times of extreme temperatures, flying foxes are protected if they attempt to find food near villages in gardens</td>
<td>Fruit bats will likely suffer with changing/delayed fruiting seasons, also affected by increasing night time temperatures (will affect their nocturnal feeding patterns)</td>
</tr>
<tr>
<td>431</td>
<td>Heat Stress</td>
<td>Environment</td>
<td>Endemic, rare or endangered species may be lost</td>
<td>Control and minimize the conversion of high montane forests through proper Land Use planning and Sustainable Ag Methods-</td>
<td>-</td>
</tr>
<tr>
<td>432</td>
<td>Heat Stress</td>
<td>Environment</td>
<td>Endemic, rare or endangered species may be lost</td>
<td>Vanuatu's international CC negotiators must be aware of and highlight to others the potential to lose very critical ecosystems and species</td>
<td>-</td>
</tr>
<tr>
<td>433</td>
<td>Heat Stress</td>
<td>Environment</td>
<td>Endemic, rare or endangered species may be lost</td>
<td>Restrict fishing activities on coral reefs that are already stressed from bleaching</td>
<td>-</td>
</tr>
<tr>
<td>434</td>
<td>Heat Stress</td>
<td>Forestry</td>
<td>Forest seeds burnt and do not have a chance to germinate</td>
<td>Germinate vulnerable seeds in controlled conditions (nurseries)</td>
<td>-</td>
</tr>
<tr>
<td>435</td>
<td>Heat Stress</td>
<td>Forestry</td>
<td>Heat Stress</td>
<td>Reconstruction and relocation of homes/communities to areas that are sheltered by forests</td>
<td>-</td>
</tr>
<tr>
<td>436</td>
<td>Heat Stress</td>
<td>Forestry</td>
<td>Heat Stress</td>
<td>Plant green spaces for outdoor congregating and relaxing</td>
<td>-</td>
</tr>
<tr>
<td>437</td>
<td>Heat Stress</td>
<td>Forestry</td>
<td>Heat Stress</td>
<td>Encourage the maintenance of trees when constructing houses</td>
<td>build around trees, incorporate them into construction designs</td>
</tr>
<tr>
<td>438</td>
<td>Heat Stress</td>
<td>Forestry</td>
<td>Trees wither and experience sun burn</td>
<td>Develop planting guidelines for each species to ensure planting in appropriate locations</td>
<td>-</td>
</tr>
<tr>
<td>439</td>
<td>Heat Stress</td>
<td>Forestry</td>
<td>Trees wither and experience sun burn</td>
<td>Identify and relocate important species to cooler locations.</td>
<td>-</td>
</tr>
<tr>
<td>440</td>
<td>Heat Stress</td>
<td>Forestry</td>
<td>Trees wither and experience sun burn</td>
<td>Plant new trees inside existing forests to exploit cooler temperatures</td>
<td>-</td>
</tr>
<tr>
<td>441</td>
<td>Heat Stress</td>
<td>Forestry</td>
<td>Trees wither and experience sun burn</td>
<td>Intercrop high canopy species in mixed planting with lower canopy species</td>
<td>-</td>
</tr>
<tr>
<td>442</td>
<td>Heat Stress</td>
<td>Forestry</td>
<td>Trees wither and experience sun burn</td>
<td>Encourage shading of germinants by mother trees</td>
<td>especially sandalwood seed trees.</td>
</tr>
<tr>
<td>443</td>
<td>Heat Stress</td>
<td>Forestry</td>
<td>Trees wither and experience sun burn</td>
<td>Utilize shade cloths/nurseries to protect vulnerable seedlings and juvenile trees from excessive heat</td>
<td>-</td>
</tr>
<tr>
<td>444</td>
<td>Heat Stress</td>
<td>Forestry</td>
<td>Trees wither and experience sun burn</td>
<td>Investigate and promote Temperature tolerant tree species</td>
<td>-</td>
</tr>
<tr>
<td>445</td>
<td>Heat Stress</td>
<td>Livestock</td>
<td>Animals are sluggish and unproductive</td>
<td>Goat is especially heat tolerant</td>
<td>-</td>
</tr>
<tr>
<td>446</td>
<td>Heat Stress</td>
<td>Livestock</td>
<td>Animals develop sunlight-related problems</td>
<td>Use antibiotics to treat the Charolais Bullock eyelid sores problem due to sunlight overexposure</td>
<td>-</td>
</tr>
<tr>
<td>447</td>
<td>Heat Stress</td>
<td>Livestock</td>
<td>Animals develop sunlight-related problems</td>
<td>Avoid sunlight vulnerable varieties of bullock like Charolais</td>
<td>Strong sunlight causes chicken’s eyes to swell up (especially in black legged fowls)</td>
</tr>
<tr>
<td>448</td>
<td>Heat Stress</td>
<td>Livestock</td>
<td>Animals develop sunlight-related problems</td>
<td>Encourage sunlight tolerant varieties of bullock like Brahman mixes</td>
<td>Crossbreed w/ Brahman and other bullock varieties are good with extreme temperatures</td>
</tr>
<tr>
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<tr>
<td>449</td>
<td>Heat Stress</td>
<td>Livestock</td>
<td>Animals develop sunlight-related problems</td>
<td>Ensure that Charolais variety is placed in the shade during the hottest and sunniest parts of the day.</td>
<td>Place shade trees for middle day times, while morning and afternoon times are best for feeding in open pastures. Nights can be spent in the open pasture. The farmer has to actually move the bullock to different areas of the farms.</td>
</tr>
<tr>
<td>450</td>
<td>Heat Stress</td>
<td>Livestock</td>
<td>Animals develop sunlight-related problems</td>
<td>Cross Charolais with Brahman to develop tolerance to high light intensity.</td>
<td>Charolais, when cross bred with Brahman, can become tolerant to high light intensity.</td>
</tr>
<tr>
<td>451</td>
<td>Heat Stress</td>
<td>Livestock</td>
<td>Animals develop sunlight-related problems</td>
<td>Place bullock in shade trees for middle day times, while morning and afternoon times are best for feeding in open pastures.</td>
<td>Charolais and Brahman are not as resilient as others with strong sunlight or high temperatures.</td>
</tr>
<tr>
<td>452</td>
<td>Heat Stress</td>
<td>Livestock</td>
<td>enclosures</td>
<td>Ventilate chicken enclosures (e.g. with bamboo floors)</td>
<td>-</td>
</tr>
<tr>
<td>453</td>
<td>Heat Stress</td>
<td>Livestock</td>
<td>enclosures</td>
<td>Provide Mulching or leaves inside chicken enclosures for temp cooling</td>
<td>-</td>
</tr>
<tr>
<td>454</td>
<td>Heat Stress</td>
<td>Livestock</td>
<td>enclosures</td>
<td>Ensure there is dust available that chickens can kick up for temp regulation</td>
<td>only for larger animals, not chicks</td>
</tr>
<tr>
<td>455</td>
<td>Heat Stress</td>
<td>Livestock</td>
<td>enclosures</td>
<td>Keep an area of small bush inside enclosures under which they can hide</td>
<td>-</td>
</tr>
<tr>
<td>456</td>
<td>Heat Stress</td>
<td>Livestock</td>
<td>enclosures</td>
<td>Cover fences, to provide shade and respite from sun</td>
<td>Malekula farmers build small shelters over their pig fences</td>
</tr>
<tr>
<td>457</td>
<td>Heat Stress</td>
<td>Water</td>
<td>Water in storage reservoirs is hot</td>
<td>White wash (paint) the tanks for sunlight reflection to keep water cool</td>
<td>-</td>
</tr>
<tr>
<td>458</td>
<td>Heat Stress</td>
<td>Water</td>
<td>Water in storage reservoirs is hot</td>
<td>Build underground tanks that are not exposed to the sun</td>
<td>drawback of underground tanks is that it is hard to spot a leak in Torres tanks under the house, but when sun is low, still heats tank</td>
</tr>
<tr>
<td>459</td>
<td>Heat Stress</td>
<td>Water</td>
<td>Water in storage reservoirs is hot</td>
<td>Plant ivy and other vines around and on tanks to keep water cold</td>
<td>-</td>
</tr>
<tr>
<td>460</td>
<td>Heat Stress</td>
<td>Water</td>
<td>Water in storage reservoirs is hot</td>
<td>Place tanks under shelters</td>
<td>-</td>
</tr>
<tr>
<td>461</td>
<td>Heat Stress</td>
<td>Water</td>
<td>Water in storage reservoirs is hot</td>
<td>Ferro cement tanks best resist high temperatures</td>
<td>may crack but can be resealed</td>
</tr>
<tr>
<td>462</td>
<td>Heat Stress</td>
<td>Water</td>
<td>Water in storage reservoirs is hot</td>
<td>Avoid poly tanks that may melt and become deformed in high temps</td>
<td>poly tanks melt and become deformed in high temps</td>
</tr>
<tr>
<td>463</td>
<td>Heat Stress</td>
<td>Water</td>
<td>Water in storage reservoirs is hot</td>
<td>Avoid fiberglass tanks that may experience inner lining peeling, and dust may have health implications</td>
<td>fiberglass tanks may experience inner lining peeling, and dust may have health implications</td>
</tr>
<tr>
<td>464</td>
<td>Sea Level Rise</td>
<td>Agriculture</td>
<td>Crops are exposed to high levels of salinity in soils</td>
<td>Relocate Gardens away from the coast</td>
<td>-</td>
</tr>
<tr>
<td>465</td>
<td>Sea Level Rise</td>
<td>Agriculture</td>
<td>Crops are exposed to high levels of salinity in soils</td>
<td>Introduce buffer zones between gardens and low-lying coastal areas</td>
<td>-</td>
</tr>
<tr>
<td>466</td>
<td>Sea Level Rise</td>
<td>Agriculture</td>
<td>Crops are exposed to high levels of salinity in soils</td>
<td>Find and encourage salt tolerant crops</td>
<td>-</td>
</tr>
<tr>
<td>467</td>
<td>Sea Level Rise</td>
<td>Environment</td>
<td>Loss of coastal habitat, flora and fauna</td>
<td>Relocate sea turtle nests to higher, safer parts of the beach</td>
<td>Wan Smolbag Vanua Tai monitors have been trained on how to do this</td>
</tr>
<tr>
<td>468</td>
<td>Sea Level Rise</td>
<td>Environment</td>
<td>Loss of coastal habitat, flora and fauna</td>
<td>Replant coastal species following their natural zonations</td>
<td>water tolerant mangroves inland to dry land mangroves and other trees</td>
</tr>
<tr>
<td>469</td>
<td>Sea Level Rise</td>
<td>Environment</td>
<td>Loss of coastal habitat, flora and fauna</td>
<td>Regulate and limit the extraction of sand, coral and gravel for development purposes</td>
<td>-</td>
</tr>
<tr>
<td>470</td>
<td>Rise</td>
<td>Environment</td>
<td>Loss of coastal habitat, flora and fauna</td>
<td>Establish protected areas on the coastal strip</td>
<td>-</td>
</tr>
<tr>
<td>471</td>
<td>Rise</td>
<td>Environment</td>
<td>Loss of coastal habitat, flora and fauna</td>
<td>Ensure the adequate EIAs are completed on all coastal developments</td>
<td>-</td>
</tr>
<tr>
<td>472</td>
<td>Sea Level Rise</td>
<td>Forestry</td>
<td>Erosion of coastal forest areas</td>
<td>Plant coastal, endemic and site adapted species on beaches and vulnerable coasts trees to control erosion</td>
<td>-</td>
</tr>
<tr>
<td>473</td>
<td>Rise</td>
<td>Forestry</td>
<td>Erosion of coastal forest areas</td>
<td>Plant/protect wetland species including mangroves to reduce erosion</td>
<td>-</td>
</tr>
<tr>
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<tr>
<td>474</td>
<td>Sea Level Rise</td>
<td>Forestry</td>
<td>Erosion of coastal forest areas</td>
<td>Encourage and assist communities to establish forested buffer zones between the coast and the village</td>
<td></td>
</tr>
<tr>
<td>475</td>
<td>Sea Level Rise</td>
<td>Forestry</td>
<td>Erosion of coastal forest areas</td>
<td>Research the potential for desalination and irrigation of coastal woodlots/plantations</td>
<td></td>
</tr>
<tr>
<td>476</td>
<td>Sea Level Rise</td>
<td>Forestry</td>
<td>Erosion of coastal forest areas</td>
<td>Relocate species of importance to higher grounds to avoid loss through sea water inundation</td>
<td></td>
</tr>
<tr>
<td>477</td>
<td>Rise</td>
<td>Forestry</td>
<td>Erosion of coastal forest areas</td>
<td>Adopt coastal management or land use plans</td>
<td></td>
</tr>
<tr>
<td>478</td>
<td>Rise</td>
<td>Forestry</td>
<td>Erosion of coastal forest areas</td>
<td>Find and encourage salt tolerant trees</td>
<td></td>
</tr>
<tr>
<td>479</td>
<td>Sea Level Rise</td>
<td>Livestock</td>
<td>Livestock are exposed to high salinity feeds and environments</td>
<td>Train bullock to use salt blocks are already bring used by some livestock owners</td>
<td></td>
</tr>
<tr>
<td>480</td>
<td>Sea Level Rise</td>
<td>Livestock</td>
<td>Livestock are exposed to high salinity feeds and environments</td>
<td>Allow animals to roam freely on the coast (Ambrym, Epi, Tanna- cows already drink the pools near the coast)</td>
<td></td>
</tr>
<tr>
<td>481</td>
<td>Sea Level Rise</td>
<td>Livestock</td>
<td>Livestock are exposed to high salinity feeds and environments</td>
<td>Allow cows and bullocks to swim in the sea In Torres – Red bullock and local bullock- regularly walk on the reef, swim in the sea</td>
<td></td>
</tr>
<tr>
<td>482</td>
<td>Sea Level Rise</td>
<td>Livestock</td>
<td>Livestock are exposed to high salinity feeds and environments</td>
<td>Allow chickens to walk on the reef flat to find food Emae- fowls walk on the reef looking for food</td>
<td></td>
</tr>
<tr>
<td>483</td>
<td>Sea Level Rise</td>
<td>Livestock</td>
<td>Livestock are exposed to high salinity feeds and environments</td>
<td>Allow pigs to scavenge on the coast In Lamap- pigs scavenge in the mangroves for food</td>
<td></td>
</tr>
<tr>
<td>484</td>
<td>Sea Level Rise</td>
<td>Livestock</td>
<td>Livestock are exposed to high salinity feeds and environments</td>
<td>Allow pigs to swim in the sea on Tongoa- white pigs commonly swim in the sea</td>
<td></td>
</tr>
<tr>
<td>485</td>
<td>Sea Level Rise</td>
<td>Livestock</td>
<td>Livestock are exposed to high salinity feeds and environments</td>
<td>To treat chicken pox, wash chickens in salt water wild chicks sent to Pentecost caught chicken pox, and were treated with sea water face wash</td>
<td></td>
</tr>
<tr>
<td>486</td>
<td>Sea Level Rise</td>
<td>Livestock</td>
<td>Livestock are exposed to high salinity feeds and environments</td>
<td>Allow chickens use minerals from the reef and beach to strengthen their eggs -</td>
<td></td>
</tr>
<tr>
<td>487</td>
<td>Sea Level Rise</td>
<td>Livestock</td>
<td>Livestock are exposed to high salinity feeds and environments</td>
<td>Relocate vulnerable pastures/enclosures away from the coast -</td>
<td></td>
</tr>
<tr>
<td>488</td>
<td>Sea Level Rise</td>
<td>Water</td>
<td>Sea water contaminates ground water</td>
<td>Use proper surveys and an altimeter to select site If not done well, as in Maskelynes, a major shift in water usage to rain water will be required</td>
<td></td>
</tr>
<tr>
<td>489</td>
<td>Rise</td>
<td>Water</td>
<td>Sea water contaminates ground water</td>
<td>Conduct a series of tests on water quality prior to installing a system often not completed in Vanuatu due to lack of funds</td>
<td></td>
</tr>
<tr>
<td>490</td>
<td>Sea Level Rise</td>
<td>Water</td>
<td>Sea water contaminates ground water</td>
<td>Ensure proper site selection for bore water E.g. Gaua- ground water best source, but 6/10 were no good, salty because checks not performed</td>
<td></td>
</tr>
<tr>
<td>491</td>
<td>Rise</td>
<td>Water</td>
<td>Sea water contaminates ground water</td>
<td>Seal bore hole when drilling -</td>
<td></td>
</tr>
<tr>
<td>492</td>
<td>Rise</td>
<td>Water</td>
<td>Sea water contaminates ground water</td>
<td>Review government internal processes and guidelines for selecting bore - Now reviewed in the National Water Strategy</td>
<td></td>
</tr>
<tr>
<td>493</td>
<td>Sea Level Rise</td>
<td>Water</td>
<td>Sea water contaminates ground water</td>
<td>Build capacity of govt and local communities on desalination options Expensive because of fuel. The brine product needs proper disposal. Skills for management and maintenance is often beyond island capacity</td>
<td></td>
</tr>
<tr>
<td>494</td>
<td>Sea Level Rise</td>
<td>Water</td>
<td>Sea water contaminates ground water</td>
<td>Use desalination in emergency situations Desalination may be useful for emergencies, (i.e. Mataso, while setting ups tanks, a small desalinator could be sent in temporarily</td>
<td></td>
</tr>
<tr>
<td>495</td>
<td>Rise</td>
<td>Water</td>
<td>Sea water contaminates ground water</td>
<td>Trial small scale inexpensive desalination technology VANREPA may have trialed a low cost design</td>
<td></td>
</tr>
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</tr>
<tr>
<td>496</td>
<td>Sea Level Rise</td>
<td>Water</td>
<td>Sea water contaminates ground water</td>
<td>Desalinate sea water</td>
<td>An NGO trialed desalination on Rah island, but was unsuccessful</td>
</tr>
</tbody>
</table>