MULTI-HAZARD EARLY WARNING SYSTEMS
REPORT FOR SAINT LUCIA, 2018

National coordination
Early Warning Systems Sub-Committee

Led by
National Emergency Management Organisation
Director
Mrs. Velda Joseph

Regional coordination
CDEMA
Regional Technical Coordinator
Ms. Alexcia Cooke

Author
Mr. Ulric Alphonse

Proof Reader
Mr. Yves Renard

Art and design: Beatriz H.Perdiguero - Estudio Varsovia

This document covers humanitarian aid activities implemented with the financial assistance of the European Union. The views expressed herein should not be taken, in any way, to reflect the official opinion of the European Union, and the European Commission is not responsible for any use that may be made of the information it contains.

UNDP
United Nations Development Programme

CDEMA
Caribbean Disaster Emergency Management Agency

IFRC
International Federation of the Red Cross and Red Crescent Societies

ECHO
European Civil Protection and Humanitarian Aid Operations
CONTENTS

1. Foreword .......................................................... 3
   1.1 Objective of the Document .................................. 4
   1.2 Background to Early Warning Demands .................... 4
   1.3 Hazards of Importance to Saint Lucia ...................... 5
   1.4 Importance of Addressing Climate Hazards of Countries in the Caribbean 6

2. Acknowledgements ................................................. 7

3. Acronyms .......................................................... 9

4. Executive Summary .............................................. 11

5. Background ....................................................... 16

6. Introduction ..................................................... 19

7. Current State of EWS in Saint Lucia ........................... 22
   7.1 Disaster Risk Knowledge .................................... 23
   7.2 Detection, Monitoring, Analysis and Forecasting of the Hazards and possible consequence 24
   7.3 Warning Dissemination and Communication ................ 25
   7.4 Preparedness and Response Capabilities .................... 26

8. Gap Analysis of the Multi-hazard Early Warning Systems of Saint Lucia 27
   8.1 Disaster Risk Knowledge .................................... 28
      8.1.1 Key hazards and Related Threats .................... 29
      8.1.2 Risk Components and Capacity ....................... 30
      8.1.3 Roles and Responsibilities of Stakeholders .......... 31
      8.1.4 Information Management for Risk Information .... 32
   8.2 Detection, Monitoring, Analysis and Forecasting of the Hazards and Possible Consequences 34
      8.2.1 Hazard Monitoring .................................... 34
      8.2.2 Hazard Forecasting and Warning Services .......... 35
      8.2.3 Institutional Mechanisms to Support Hazard Monitoring, Forecasting and Warnings 36
8.3 Warning Dissemination and Communication ............................................. 37
  8.3.1 Organizational and Decision-Making System ........................................ 37
  8.3.2 Communication Systems and Equipment ............................................. 38
  8.3.3 Efficacy of Impact-Based Early Warnings for Prompting Action by Target Groups ............................................. 39
8.4 Preparedness and Response Capabilities ................................................... 40
  8.4.1 Disaster Preparedness and Response Readiness ..................................... 40
  8.4.2 Public Awareness and Education Programmes ..................................... 42
  8.4.3 Public Awareness and Response Testing ............................................. 42
8.5 Hazard-Specific Gaps ................................................................................. 43

9. Recommendations .......................................................................................... 45
  9.1 Disaster Risk Knowledge ........................................................................... 46
  9.2 Dection, Monitoring, Analysis and Forecasting of the Hazards and Possible Consequences ............................................. 48
  9.3 Warning Dissemination and Communication ............................................. 48
  9.4 Preparedness and Response Capabilities ................................................. 49

10. Conclusion .................................................................................................... 50
11. References ..................................................................................................... 51
1. FOREWORD
1. FOREWORD

1.1. OBJECTIVE OF THE DOCUMENT

The objective of the document is to report on the Multi-Hazard Early Warning System (MHEWS) in Saint Lucia, identifying gaps in the system based on the application of the MHEWS Checklist, and making appropriate recommendations to address the gaps.

The application of the checklist was made possible under a project entitled “Strengthen Integrated Early Warning System (EWS) in the Caribbean through knowledge and tool transfer” which seeks to improve EWS for more effective disaster risk reduction in the Caribbean, and to move towards the realization of a more integrated system, through concrete actions addressing identified gaps.

1.2. BACKGROUND TO EARLY WARNING DEMANDS

We all understand the importance of finding ways of reducing risks and one of the best ways to achieve this is to warn people in advance, so that they can take the appropriate action. This dictates the need for multi-hazard early warning systems that utilize science, technology, and innovation to offer us greater opportunities for understanding what is happening around us. Early warning is a major element
of DRR as it can prevent loss of life and reduce the economic and material impacts of hazardous events including disasters.

Saint Lucia, by virtue of its geographic location, physical formation and fragile ecosystems, is at risk from a number of natural, technological and human-induced hazards. These hazards have the potential to cause loss of lives, severe damage to infrastructure and other economic assets, as well as cause adverse effects on livelihoods. Tropical Storm Debbie in 1994 and the tropical wave in 1996, for example, resulted in cumulative damages of US$93.1 million to property and infrastructure across the island. Hurricane Tomas in 2010 affected major sectors of the economy and diminished growth, with the total impact estimated at US$336 million, or roughly 34 percent of Saint Lucia’s Gross Domestic Product (GDP). The December 24, 2013 flood event resulted in total damage and loss of US$99.88 million (EC$267.76 million), equivalent to 8.3 percent of Saint Lucia’s GDP 1.

Interventions at the national level towards measurably reducing vulnerability to natural hazards and the adverse effects of climate change in Saint Lucia have involved significant physical prevention and mitigation works, strengthening emergency preparedness and early warning systems, as well as training and capacity development for community-based disaster management organisations, shelter managers and the staff of the National Meteorological Services (NMS). The National Emergency Management Organisation (NEMO) also continues to develop and revise national emergency management plans for specific hazards and to facilitate the development of sectoral/agency multi-hazard plans. These advancements as well as others, have contributed significantly and continue to contribute to the state of readiness of the country. However, notwithstanding progress made with respect to advancing Comprehensive Disaster Management (CDM) and promoting initiatives for disaster risk and disaster loss reductions, there is still a need to strengthen EWS particularly for tropical cyclones, floods, tsunamis and volcanic events. Improvements are also required for data collection particularly for hydrological and meteorological monitoring networks.

1.3. HAZARDS OF IMPORTANCE TO SAINT LUCIA

Saint Lucia, like other Caribbean Countries, is vulnerable to a myriad of hazards. Some of the natural hazards include hurricanes, flooding, landslides, tsunamis, droughts and seismic and volcanic activity. Tropical storms and hurricanes are also frequently accompanied by cascading events like storm surges, floods and landslides, which give rise to soil, beach and/or coastal erosion. Technological and human-induced hazards include explosions, oil and hazardous material spills, mass casualty, civil unrest, fires and information and communication technology disruptions.

The combination of past events coupled with hazard analysis and a probability of a repeat event has been applied by various agencies to determine the risk level of those and other phenomena. The complete Saint

---

The importance of addressing climate hazards of countries in the Caribbean generally, and Saint Lucia specifically, cannot be overestimated. The recent passage of Category 5 Hurricanes Irma and Maria highlight the need to pay serious and urgent attention to such events. The consequences of natural disasters for economic activities, property, human welfare and natural resources can be devastating. In the Caribbean, these events have greatly affected the productive sectors of the economy such as agriculture and tourism, not to mention the impact on communities, in particular the poor. On average, at least one major hurricane and numerous tropical storms cross the Caribbean each year and historical data shows that within this region, individual countries have incurred losses exceeding their annual GDP from a single hurricane event. Climate change is likely to make matters worse as extreme weather events may occur more frequently and with greater intensity, sea-level rise would magnify the impact of storm surge and waves on coastal areas, while protective eco-systems like coral reefs and mangroves would be weakened by increased sea-surface temperatures and changes in salinity.

With increasing frequency, countries in the region are facing situations in which scarce resources that were earmarked for development projects have to be diverted to relief and reconstruction following disasters, thus setting back economic growth. Recent experiences in countries such as Jamaica, Dominican Republic and the OECS countries confirm that economic growth recovers slowly from a major natural disaster. Disasters also directly impact the foreign exchange earnings capacity of a country, at a time when extra resources are needed to finance imports of food, energy, and inputs for the agricultural and manufacturing sectors.
2. Acknowledgements
2. ACKNOWLEDGEMENTS

The author would like to thank the individuals from the various agencies who took time to respond to the survey questionnaires. The tremendous assistance of the Mrs. Velda Joseph, Director of NEMO, is greatly acknowledged. Gratitude is also extended to the Deputy Director of NEMO. Thanks also to the United Nations Development Programme, Caribbean Disaster Emergency Management Agency, International Federation of Red Cross and Red Crescent Societies and Disaster Preparedness Programme European Commission Humanitarian Aid Department for ensuring the implementation of the project to strengthen integrated EWS for more effective disaster risk reduction in the Caribbean through knowledge and tool transfer. The assistance of Miss Yvonne Barthelmy and Mr. Yves Renard is acknowledged for their contribution to the production of this final document.
3. ACRONYMS
## 3. ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CADM</td>
<td>Caribbean Disaster Management Project</td>
</tr>
<tr>
<td>CAP</td>
<td>Common Alerting Protocol</td>
</tr>
<tr>
<td>CDEMA</td>
<td>Caribbean Disaster Emergency Management Agency</td>
</tr>
<tr>
<td>CDM</td>
<td>Comprehensive Disaster Management</td>
</tr>
<tr>
<td>DRR</td>
<td>Disaster Risk Reduction</td>
</tr>
<tr>
<td>EWS</td>
<td>Early Warning System</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>FEWERS</td>
<td>Fisheries Early Warning and Emergency Response System</td>
</tr>
<tr>
<td>FEWS</td>
<td>Flood Early Warning System</td>
</tr>
<tr>
<td>Hydro-met</td>
<td>Hydro meteorological</td>
</tr>
<tr>
<td>IFRC</td>
<td>International Federation of Red Cross and Red Crescent Societies</td>
</tr>
<tr>
<td>MHEWS</td>
<td>Multi-Hazard Early Warning Systems</td>
</tr>
<tr>
<td>MoU</td>
<td>Memorandum of Understanding</td>
</tr>
<tr>
<td>NEMO</td>
<td>National Emergency Management Organisation</td>
</tr>
<tr>
<td>PAHO</td>
<td>Pan American Health Organisation</td>
</tr>
<tr>
<td>SMS</td>
<td>Short Message Service</td>
</tr>
<tr>
<td>SOP</td>
<td>Standard Operating Procedure</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
</tr>
<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
</tr>
<tr>
<td>VCA</td>
<td>Vulnerability and Capacity Assessment</td>
</tr>
<tr>
<td>WRMA</td>
<td>Water Resource Management Agency</td>
</tr>
<tr>
<td>WASCO</td>
<td>Water and Sewerage Company</td>
</tr>
</tbody>
</table>
4. EXECUTIVE SUMMARY
4. EXECUTIVE SUMMARY

This report provides an analysis and evaluation of the Multi-Hazard Early Warning System (MHEWS) of Saint Lucia. It highlights the current state of EWS in Saint Lucia, identifies existing gaps in the system and provides recommendations for addressing these gaps.

The Sendai Framework for Disaster Risk Reduction (DRR) 2015-2030 refers to an early warning system as a critical element for DRR. In fact, one of the seven global targets calls for a substantial increase of MHEWS which are an important element to implement the Sendai Framework. Furthermore, the development, maintenance, sustainability and strengthening of early warning systems (EWS) is part of the Comprehensive Disaster Management (CDM) Strategy and Programming Framework (2014-2024) championed by the Caribbean Disaster Emergency Management Agency (CDEMA) and adopted by its Participating States. EWS are also well recognized as a critical life-saving DRR tool and it is internationally recommended that effective EWS reflect the following components:

- Risk Knowledge
- Monitoring and Warning Service
- Dissemination and Communication
- Response Capability

In Saint Lucia, there is widespread acknowledgement of the need for a people centered end-to-end Multi-Hazard Early Warning System to provide timely alerts to the population given the vulnerability/exposure of the island to multiple hazards. However, the implementation of such a system has been somewhat

---

2. By virtue of its geographic location, physical formation and fragile ecosystems, Saint Lucia is extremely vulnerable to a number of natural, technological and human-induced hazards which includes hurricanes, floods, landslides, droughts, tsunamis, seismic and volcanic activity, explosions, oil and hazardous material spills, mass casualty, civil unrest, fires and information and communication technology disruptions.
piecemeal with various components being implemented under particular projects. In 2011/12, a Flood Early Warning System was installed in Corinth, Gros-Islet under the Caribbean Disaster Management Project (CADM) Phase II but this system is currently non-functional. In 2015, a flood early warning siren system was implemented in three vulnerable communities namely Marchand, Anse-La-Rayé and Canaries. This system, which was financed through a grant from the Australian government and implemented through the Water Resources Management Agency (WRMA), is still functional but is not Common Alerting Protocol (CAP) compliant and therefore requires the physical presence of an individual at the NEMO Secretariat/control centre to facilitate the issuance of warning messages. The more recent intervention as it relates to EWS was the piloting of a CAP compliant Multi-Hazard EWS in the village of Dennery on the east coast of Saint Lucia in 2017 under the project: “Strengthening resilience and coping capacities in the Caribbean through integrated early warning systems”. Although this system is capable of facilitating information dissemination via multiple mediums, warning messages are currently being shared through a Smartphone Application (CAPCAP) as well as Radio Broadcast Interrupts located at three radio stations – HOT FM, Helen 100 FM, and Radio Caribbean International. Optimal utilization of the system is envisaged in the near future.

Notwithstanding advances to date, it is noted that there is still a need to comprehensively improve EWS particularly for storms, floods, tsunamis and volcanic events. Improvements are also required for data collection particularly for hydrological and meteorological monitoring networks at both local and national scales. In an effort to collect data on specific gaps or areas for improvement, the MHEWS Checklist, a tool intended to ensure that the major elements of an effective EWS are in place, was administered via SurveyMonkey to forty-three (43) agencies from local to national level. The methodology utilized also included personal interviews, a review of related documentation and an analysis of the results of the survey and interviews.

A workshop was convened on 22 May, 2018 to validate the gaps identified based on a gap analysis undertaken and to provide inputs into the development of a national roadmap for improving Saint Lucia’s MHEWS. The workshop sought to achieve the following objectives:

» Familiarise MHEWS Stakeholders with the gap analysis results from the application of the MHEWS Checklist
» Provide technical input to the revision of the national MHEWS report through the validation of the gaps

The checklist identifies four major components that should be considered in the development of or evaluation of EWS, namely:

1. Disaster Risk Knowledge
2. Detection, monitoring, analysis, and forecasting of the Hazards and possible consequences
3. Warning Dissemination and Communication
4. Preparedness and Response Capabilities.

3. The CADM 11 Project was implemented in the Caribbean during the period 2009 – 12. The overall goal of the project is to mitigate damages in CDERA (now CDEMA) member states particularly for the flood hazard. The initiative was funded by the Government of Japan through the Japan International Cooperation Agency (JICA) and administered through CDEMA.
The evaluation revealed that whereas significant progress has been achieved, there exist gaps in all areas that need to be addressed to enhance the efficacy of the MHEWS. The gaps identified pertained to policy, institutional, capacity and knowledge issues. They are classified in this report as hazard specific gaps and system wide gaps under the four main components as presented in the checklist and listed above.

The results of the workshop included a list of validated MHEWS gaps and recommendations. As it relates to disaster risk knowledge, it was determined that risk, vulnerability and capacity assessments need to be undertaken for all sectors, taking into account gender issues, as well as vulnerable persons or persons in vulnerable areas. There is also a need for enacting the CDM legislation and regulations as well as the establishment of an MHEWS committee to coordinate arrangements. All members of NEMO need to be refreshed on the scope of NEMO and their roles and responsibilities based on Standard Operating Procedures (SOPs).

Key gaps noted were the general absence of risk management plans at the local level and the limited consideration given to the integration of historical and indigenous knowledge in such plans in the areas where they may exist. Additionally, the existence, functioning and actions of established institutions/bodies as it pertains to specific hazards, for example, the Flood and Drought Committee, is relatively foreign to the general population, indicating a need for public education regarding these systems.

In terms of detection, monitoring, analysis and forecasting of hazards and possible consequences, there appears to be little known among stakeholders about the monitoring of hazards, particularly as it relates to geological hazards. It was also indicated that the high operational and maintenance costs of monitoring networks have resulted in sustainability issues related to the consistency of data collection. The different networks have low levels of inter-operability given the different origins of the hardware obtained. In that regard, it is recognised that there is a need to have systems tailored to the country’s needs.

With respect to Warning Dissemination and Communication, the absence of a national central repository of disaster and risk information as well as the insufficiency of available financing for response actions due to limited budgetary allocations were highlighted as major impediments. As it pertains to warnings, the Common Alerting Protocol (CAP) system exists but the alerting siren system associated with the flood early warning system (FEWS) for Marchand, Anse-La-Ray and Canaries is not CAP compliant and therefore cannot be activated virtually. Additionally, it was highlighted that many of the radio stations do not have the capacity to function for an inordinate power outage period due to the absence of backup generators.

There is the recognition among stakeholders that while messages are disseminated, there has been no formal mechanism put in place to verify that warnings have been received and to correct potential failures. It was also suggested that there is a need for legislation to ensure that all radio and television stations support broadcast interrupts and that there is reference to having back up power as a requisite for licensing. Redundancy in communication systems is also a weakness in the system to which participants suggested the need for training of community level groups in the use of ham radios among other actions. There was also a suggestion to take advantage of the local government system to disseminate information. In order to ensure proper coordination in dissemination and communication of information the need for regular review and planning meetings among warning issuers was considered a necessity.
As it relates to Preparedness and Response Capabilities, it was acknowledged that limited consideration of vulnerable groups in the development of response plans and building capacities was a shortcoming of the disaster management process. Limited budgetary allocation for supporting response actions and for undertaking preparatory simulation exercises was also cited as a challenge. Likewise, there is limited financial and technical support for EWS operations both locally and nationally. In addition, drills and exercises with first responders and communities are not done frequently. Moreover, the apparent absence of protocols to evacuate last mile operators and the disregard for SOPs that make provisions for debriefing sessions for emergency response personnel were also deemed to be gaps that need to be addressed.

For improved preparedness and response, it was noted that the public needed to be better prepared through public awareness and education as well as through training to build capacities for response. It was also deemed necessary that training activities highlight more sustainable preparedness measures for longer return periods and cascading hazard events.

Detailed gaps and recommendations are presented under the related four major components and are in keeping with the Sendai Framework for Disaster Risk Reduction 2015-2030.
5. BACKGROUND
5. BACKGROUND

Saint Lucia is situated in the Lesser Antillean Arc of the Caribbean Archipelago at latitude 13° 53’ north and longitude 60° 68’ west and situated on a volcanic ridge between Martinique to the North and St. Vincent and the Grenadines to the south. The island is 42 km long, 22 km wide, and has a land area of 616 km², and is characterized by mountainous and rugged topography, with steep slopes cut by fast-flowing rivers.

The estimated population of Saint Lucia as at the 2010 Census was 166,526, with 51.1% female and 48.9% male. 24.4% of the population are under 14 years (male 20,035/female 19,021) and 66.4% between 15 and 64 years (male 51,593/female 54,843). Persons over 60 years make up 8.6% (male 6,668/female 8,107) of the population, with 75% of this age group being female. Saint Lucia’s island wide population density is approximately 796 persons per square mile, with large segments of the island’s population located along the coastal belt, where low land agriculture, coastal resources, reefs, fisheries and tourism are the main sources of livelihood.

Approximately 60% of the population resides along the north-west corridor. The island’s population is rapidly becoming urbanised, with approximately 41% of the total population residing in the city of Castries and 55% of the population residing in the Castries-Gros Islet corridor (Figure 1).

The Saint Lucia Country Document for Disaster Risk Reduction (2014) provides a good overview of the physical environment and socio-economic context of the country highlighting vulnerable areas and population. A positive correlation has been demonstrated with increasing incidence of poverty and

---

4. The incidence of poverty is slightly higher among men than among women, 29% and 25% respectively. The incidence of poverty among female headed households (21.2%) is about the same as among male headed households (22%) (Saint Lucia Population & Housing Census 2010).
increased vulnerability to impacts of disasters and climate change impacts (e.g. rainfall changes, sea level rise and storm surge)\textsuperscript{5}.

\textbf{Figure 1. Saint Lucia Population 2010}

6. INTRODUCTION
Disasters are typically seen as distinct events, such as a rainstorm, hurricane or earthquake. Damage from a disaster event, however, is the result of vulnerability that existed prior to the event. Little can be done to reduce the occurrence and intensity of most natural hazards, but their effects can be minimized through disaster preparedness and mitigation activities to safeguard lives, and hazard risk management activities and programs to reduce existing and future vulnerability to damage and loss. Reducing vulnerability to near-term climate hazards is also an effective strategy for reducing long-term risks to the effects of climate change.

Installation of effective and functional EWS are an important part of building resilience to the effects of disasters. EWS are means by which people receive relevant and timely information in a systematic way prior to a disaster in order to make informed decisions and take action. The word system is used to refer to the interplay between an array of elements aimed at facilitating communication and prompt response to protect and aid those in need.

There are four basic elements to an EWS where each part must function efficiently for the system to be successful:

- **Disaster Risk Knowledge** builds the baseline understanding about risks (hazards and vulnerabilities) and priorities at a given level.

- **Detection, Monitoring, Analysis and Forecasting** is the logical follow-on activity to keep up-to-date on how those risks and vulnerabilities change through time.

- **Warning Dissemination and Communication** packages the monitoring information into actionable messages understood by those that need, and are prepared, to hear them.
• *Preparedness and Response Capabilities* insists on each level being able to reduce risk once trends are spotted and announced. This may be through pre-season mitigation activities, evacuation or duck-and-cover reflexes, depending on the lead-time of a warning.

This report presents an evaluation of these four key elements aligned to the themes of the MHEWS Checklist revised in February 2018. It presents a synopsis of the state of EWS in Saint Lucia, MHEWS gaps and recommendations for addressing these gaps.
7. CURRENT STATE OF EWS IN SAINT LUCIA

7.1 Disaster Risk Knowledge

7.2 Detection, Monitoring, Analysis and Forecasting of the Hazards and possible consequences

7.3 Warning Dissemination and Communication

7.4 Preparedness and Response Capabilities
7. CURRENT STATE OF EWS IN SAINT LUCIA

Based on information gathered, a summary of the current state of EWS in Saint Lucia is presented in Tables 1-4 in keeping with the four components of EWS.

7.1. DISASTER RISK KNOWLEDGE

The current status of EWS as it relates to Disaster Risk Knowledge is summarized in Table 1 below:

<table>
<thead>
<tr>
<th>NO.</th>
<th>CURRENT STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Information is available on the characteristics of key hazards as there exists a catalogue/inventory of disasters/hazard impacts over the years. (1700 – 2016)</td>
</tr>
<tr>
<td>2.0</td>
<td>Utilizing the Vulnerability and Capacity Assessment (VCA) methodology, a number of community hazard maps have been produced by the St. Lucia Red Cross. Additionally, in 2017, through a joint initiative of NEMO and the Ministry of Equity, Social Justice, Empowerment, Youth Development, Sports and Local Government, hazard maps were developed for four communities in Saint Lucia, namely Des Barras (Babonneau), Millet, Malgretoute (Micoud) and Laborie Village. Hazard mapping was also done in Choiseul as part of a Climate Smart Community Disaster Management Workshop sponsored by the Caribbean Disaster Emergency Management Agency (CDEMA) in 2014.</td>
</tr>
<tr>
<td>3.0</td>
<td>Under the Disaster Vulnerability Reduction Project (DVRP), financial resources have been allocated to conduct a landslide risk assessment for Saint Lucia.</td>
</tr>
</tbody>
</table>
In 2000, the Government of Saint Lucia established the Programme for the Regularization of Unplanned Developments (PROUD) to, among other things, regularize several squatter settlements. This involved providing infrastructure, adequate drainage, and proper garbage collection, all of which contribute to reducing the negative impact of hazards.

Existing legislation has been assessed with a view to identifying gaps that may, among other things, increase vulnerability of persons and communities. The Disaster Management Act # 30 of 2006 was assessed/reviewed in 2013/14, gaps identified and an updated Comprehensive Disaster Management Legislation drafted. There also exists draft Early Warning Systems Regulations.

The Disaster Management Act #30 of 2006 also identifies NEMO as the agency for coordinating hazard identification and risk information.

SOPs exist which detail the roles and responsibilities of all stakeholders/agencies of NEMO. If these are adhered to, this should ensure the smooth operation of the system.

**Table 1: Synopsis of elements of Disaster Risk Knowledge**

### 7.2. DETECTION, MONITORING, ANALYSIS AND FORECASTING OF THE HAZARDS AND POSSIBLE CONSEQUENCES

Table 2 (below) provides a summary of the current status of EWS as it relates to the component named above.

<table>
<thead>
<tr>
<th>NO.</th>
<th>CURRENT STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Monitoring systems are in place for specific hazards. The Saint Lucia Meteorological Office has monitoring networks for meteorological hazards. The Seismic Research Centre also has established networks to monitor seismic and volcanic activity in Saint Lucia. A Hydro-meteorological (Hydro-met) network exists throughout the country under the mandate of the national Meteorological Office and the Water Resources Management Agency (WRMA).</td>
</tr>
<tr>
<td>2.0</td>
<td>Forecasting and warning services are in place for weather-related hazards. The Meteorological Office is the agency responsible for the rainfall forecasts. It alerts NEMO and the public regarding the likelihood of extreme weather events.</td>
</tr>
<tr>
<td>3.0</td>
<td>Measurement parameters and specifications are documented for certain hazards. For instance, standard precipitation Indices (1 month, 6 months and 12 months) are calculated by the National Meteorological Office and these are compared to monthly hydrological base flows that are calculated by the WRMA.</td>
</tr>
</tbody>
</table>
### Table 2: Synopsis of elements of Detection, Monitoring, Analysis and Forecasting of the Hazards and Possible Consequences

#### 7.3. WARNING DISSEMINATION AND COMMUNICATION

The current status of EWS as it relates to Warning Dissemination and Communication is summarized in Table 3 below:

<table>
<thead>
<tr>
<th>NO.</th>
<th>CURRENT STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.0</strong></td>
<td>A MoU is in place with the three (3) media houses where the Radio Broadcast Interrupt has been installed (HOT FM, Helen 100 FM &amp; Radio Caribbean International). This MoU essentially sets the responsibilities of both parties (NEMO &amp; Radio Station) with respect to the dissemination of the warning messages through the Interrupt, as well as care and maintenance of the equipment.</td>
</tr>
<tr>
<td><strong>2.0</strong></td>
<td>Upon activation of the National Emergency Operations Centre (NEOC), the National Public Education and Information Committee establishes its hub at the NEMO Secretariat from where all information/warning messages are disseminated to groups that have been authorised to receive and disseminate these warnings (e.g. liaison officers group, District Disaster Committees, National Disaster Management Committees, Permanent Secretaries, Private Sector, among others). This addresses the issues of accuracy and authenticity of information.</td>
</tr>
<tr>
<td><strong>3.0</strong></td>
<td>A combination of communication and dissemination systems, including short message service (SMS) messages, radio and television broadcasts, town criers, public address systems, church bells is currently being utilized to alert the public.</td>
</tr>
</tbody>
</table>
The National Emergency Management Plan, inclusive of SOPs, provides guidance as it relates to agency roles and responsibilities pre and post disasters including the dissemination of early warning information which will enhance collaboration among the agencies in response to disasters.

NEMO and its various agencies implement many education programs and activities to heighten the awareness of the population as it relates to their preparation, conduct and response regarding adverse events.

NEMO has supplied and installed handheld radios for use by all local district disaster committees and provided the requisite training.

Table 3: Synopsis of elements of Warning Dissemination and Communication

7.4. PREPAREDNESS AND RESPONSE CAPABILITIES

Table 4 (below) provides a summary of the current status of EWS as it relates to Preparedness and Response Capabilities.

Table 4: Synopsis of elements of Preparedness and Response Capabilities
8. GAP ANALYSIS OF THE MULTI-HAZARD EARLY WARNING SYSTEMS OF SAINT LUCIA

8.1 Disaster Risk Knowledge

8.2 Detection, Monitoring, Analysis and Forecasting of the Hazards and Possible Consequences

8.3 Warning Dissemination and Communication

8.4 Preparedness and Response Capabilities
8. GAP ANALYSIS OF THE MULTI-HAZARD EARLY WARNING SYSTEMS OF SAINT LUCIA

8.1. DISASTER RISK KNOWLEDGE

The MHEWS checklist recognizes that risks arise from the combination of hazards, exposure of people and assets to the hazards and their vulnerabilities and coping capacities. Effective assessment of these risks necessitates systematic collection and analysis of data that will contribute tremendously towards effective disaster management measures and reduction in the negative impact of disasters. Whereas significant strides have been made in this area it is clear that there are some aspects that need to be addressed if the resilience of individuals and communities is to be strengthened. This component will be examined under four (4) headings namely: Key Hazards and Related Threats; Risk Components and Capacities; Roles and Responsibilities of Stakeholders; and Information Management for Risk Information.

Saint Lucia has developed a catalogue/inventory of disasters/hazards covering the period 1700 to 2016 in which there is information on the hazards which have impacted the island. In 2006, a national risk register was developed which provides a ranking of the risk associated with the various hazards to which the island is exposed. Complementary to the foregoing is the Vulnerability and Capacity Assessment (VCA) methodology that has been used by the St. Lucia Red Cross to develop a number of community hazard maps. Further, utilizing this VCA methodology, through a joint initiative of NEMO and the Ministry of Equity, Social Justice, Empowerment, Youth Development, Sports and Local Government, hazard maps were developed for four communities in Saint Lucia, namely Des Barras.

---

6. MHEWS Checklist
(Babonneau), Millet, Malgretoute (Micoud) and Laborie Village in 2017. Hazard mapping was also done in Laborie as part of a Climate Smart Community Disaster Management Workshop sponsored by the Caribbean Disaster Emergency Management Agency (CDEMA) in 2014. It is also noted that under the Disaster Vulnerability Reduction Project (DVRP), financial resources have been allocated for conducting a landslide risk assessment for Saint Lucia.

The establishment of the Programme for the Regularization of Unplanned Developments (PROUD) in 2000 by the Government is also an effort to reduce the negative impact of hazards through, among other things, regularizing several squatter settlements. This involved providing infrastructure, adequate drainage, and proper garbage collection.

Existing legislation has been assessed with a view to identifying gaps that may, among other things, increase vulnerability of persons and communities. The Disaster Management Act # 30 of 2006 was assessed/reviewed in 2013/14, gaps identified and an updated Comprehensive Disaster Management Legislation drafted. There also exists draft Early Warning Systems and other Regulations for enactment by the Government of Saint Lucia. The Disaster Management Act #30 of 2006 also identifies NEMO as the agency for coordinating hazard identification and risk information. SOPs exist which detail the roles and responsibilities of all stakeholders/agencies of NEMO. If these are adhered to, this should ensure the smooth operation of the system.

8.1.1 KEY HAZARDS AND RELATED THREATS

Currently, limitations exist in the analysis of the characteristics of key hazards. Information is available but the inadequacy of human resource capacity restricts analysis which would help guide future action. Additionally, often times, analyses conducted by various government agencies focus on specific issues and do not integrate an analysis of risks. For example, the relevant analysis conducted by the Ministry of Equity, Social Justice, Empowerment, Youth Development, Sports, Culture and Local Government, during the Country Poverty Assessment (2005/06) focused on poverty reduction and did not adequately consider the linkages or relationships to existing vulnerabilities or the potential impact of natural hazards. There is need to expand such assessments and to develop/consider the links or relationships between these (poverty) assessments and the occurrence or impacts and implications of various hazardous events. Further, hazard analysis and risk assessments do not consider gender, disability, economic diversity, access to infrastructure, societal inequalities and other such vulnerability factors.

Where community hazard maps have been produced by the Red Cross and community representatives utilizing the Vulnerability and Capacity Assessment (VCA) methodology, these maps depict areas that could be affected by hazards but do not include quantification of exposed persons or gender differentiated vulnerability data. Also, the digitization of these maps has not materialized.

There is evidence that both women and men have been involved in the development of hazard and risk maps where these exist but this normally occurs during organized training programs to which both women and men are invited. Both sexes participate fully in these workshops and associated hazard mapping exercises undertaken as part of the activities. However, this does not occur specifically
within the context of main organizational groups nor is there any deliberate policy to cater for equal participation of both genders.

### 8.1.2. RISK COMPONENTS AND CAPACITY

Regarding the assessment of exposure, vulnerabilities, capacities and risks, the Water and Sewage Company (WASCO) is in the process of conducting and documenting the results of such an assessment for the water sector. Also, during the 2017 NEMO Annual General Meeting of NEMO, the Prime Minister and Chairman of NEMO directed the Ministry of Infrastructure, Ports, Energy and Labour to undertake a risk assessment of critical infrastructure/services throughout the island. However, to date, this has not been done. It is not certain whether other agencies have undertaken this necessary activity but it believed that this is an aspect that can be addressed through policy requirement.

There is certainly an increased awareness of the need to evaluate potential risks and to consider risk management solutions to increase resilience of critical infrastructure. However, this seems to be limited to simply awareness and needs to be given serious attention to precipitate relevant action. It should be noted that there is a ‘Standard for Conducting Hazard Mapping, Vulnerability Assessment and Economic Valuation for Risk Assessment for the Tourism Sector’ tool available for use by countries including Saint Lucia.

It is recognized that full-scale geotechnical investigations and studies are essential for the determination of the long term stability of regions which have experienced major landslides. Fond St Jacques and the outer residential slopes of Castries, and other areas need critical attention as the potential for loss of life and property in these areas is high. It is worth noting that under the Disaster Vulnerability Reduction Project (DVRP), financial resources have been allocated for the conduct of a landslide risk assessment for Saint Lucia.

Still on the issue of risk assessments, the survey showed that the integration of historical and indigenous knowledge into risk assessments does not feature prominently when mitigation works are being undertaken. There are instances when residents are not happy with infrastructural works done in their neighborhood without prior consultation or engagement as in the case of the construction of the gabion baskets in the Laborie main drain. These baskets have since collapsed as predicted by residents in the immediate vicinity. The draft Saint Lucia Fisheries Early Warning and Emergency Response System (FEWERS) report indicates that some fishers may look at a tree’s movement before setting to sea to get wind speed and direction, so local knowledge and practices that provide simple useful information must not be dismissed.

There is evidence that some actions of the population such as poor disposal of solid waste and unplanned developments in hazard prone areas increase vulnerability and risk. In some instances, it is perceived that even major developments sanctioned by the Development Control Authority create risks for other areas. However, more research needs to be undertaken to assess how the impact of activities of people

---

or groups increase or compound risk with a view to addressing these. When conducting local area mapping of Flood Early Warning Systems (FEWS), general activities of the community/area that increase or compound risks are considered but there is also a need for consideration of gender specific issues as women and men react to traumatic experiences differently.

There is a general absence of risk management plans at the local level and there is need to address this dearth of local risk management plans. However, where risk assessments are undertaken, it is imperative that the results of these assessments be integrated into local risk management plans or development plans. In addition, these plans must address the issue of warning messages, ensuring that they are disseminated in a clear and easy to understand language.

As it relates to the enabling environment for advancing Comprehensive Disaster Management (CDM) inclusive of a focus on risk management, the survey revealed that the revised and updated CDM legislation and EWS regulations have not been finalized/ratified. It is the intention of NEMO to facilitate another round of public consultation towards finalization and ratification of these pieces of legislation ensuring that existing gaps are addressed. NEMO commits to the finalization of these documents by the end of 2018 and should seek to meet this targeted deadline.

The responsibility for coordinating hazard identification and risk information should be assigned to one national organization with a view to consolidating approaches and monitoring linkages and cascading impacts. The absence or ignorance of the existence of such an entity, can impede progress in mitigating the effects of hazards. Results of the survey revealed that there is serious need for this area to be addressed. Whereas respondents generally recognized that NEMO should be that coordinating agency, and an examination of the relevant legislation revealed that NEMO is that agency, respondents were divided equally as to whether there was moderate progress, minimal or no progress or major progress towards this standard. This suggests that the status of the National Emergency Management Organization (NEMO) as the coordinating agency responsible for fulfilling this mandate must be explicitly stated and communicated.

Communication channels and early warning systems are also recognized as key to reducing negative impacts of hazards. The need for hardware resilience as well as backup systems (servers) was highlighted as critical during the implementation of Phase 1 of the Multi-Hazard Early Warning System (MHEWS) in Saint Lucia. Consequently, hardware resilience must be evaluated in advance to reduce the impact of events on infrastructure. This is critical since system failure will decrease the probability of wide reach of warnings. Every effort must therefore be made to ensure that these systems remain functional during adverse conditions if they are to serve their intended purpose.

### 8.1.3. ROLES AND RESPONSIBILITIES OF STAKEHOLDERS

Similar to the absence of information for decision making, confusion about roles and responsibilities of stakeholders can have a devastating effect on disaster response and management. It is therefore of utmost importance that the roles and responsibilities of stakeholders be clarified, communicated and understood.

---

8. Disaster Management Act #30 of 2006
This will serve to prevent confusion and duplication and ensure efficiency and effective utilization of resources.

The SOPs that detail the roles and responsibilities of the agencies of NEMO and other stakeholders requires updating as the last review/update was done in 2005. This document which forms part of the National Emergency Management Plan must be updated, through a process of consultation with stakeholders and disseminated widely to encourage familiarity with roles and responsibilities.

8.1.4. INFORMATION MANAGEMENT FOR RISK INFORMATION

There has been much discussion on the issue of the establishment of a standard repository of event/disaster and risk information but this has not yet materialized. There is therefore no established central repository for the country and there are no national standards for the systematic collection, sharing and assessment of risk information and data related to hazards, exposures, vulnerabilities and capacities or information readily available to assist with DRR activities. However, the NEMO Secretariat is host to a comprehensive database of hazard impacts to Saint Lucia dating from 1760 – 2016.

Gaps associated with disaster risk knowledge are detailed in Table 1 below.

Table 1. Disaster Risk Knowledge gaps

<table>
<thead>
<tr>
<th>Disaster Risk knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of hazard and risk maps does not cater for equal participation of both genders.</td>
</tr>
<tr>
<td>The aspect of gender is not factored in the installation of EWS systems.</td>
</tr>
<tr>
<td>Assessment of vulnerabilities and risks is done in the major economic sectors of agriculture &amp; tourism in particular, but is lacking in the other sectors.</td>
</tr>
<tr>
<td>There is a general absence of risk management plans at the local level.</td>
</tr>
<tr>
<td>Existing legislation has been assessed with a view to identifying gaps that may increase vulnerability of persons and communities but this still exists in draft.</td>
</tr>
<tr>
<td>Poverty assessment exercises do not take into consideration the possible occurrence of various hazardous events.</td>
</tr>
<tr>
<td>Limited consideration is given to the integration of historical and indigenous knowledge into risk assessments.</td>
</tr>
<tr>
<td>There has not been an assessment of how the impact of activities of people or groups increase or compound risk.</td>
</tr>
</tbody>
</table>
### Disaster Risk knowledge

The reviewed and updated Comprehensive Disaster Management Legislation is still in draft form. Draft regulations to accompany the Comprehensive Disaster Management Act have been prepared but not yet ratified.

The status of NEMO as the coordinating agency responsible for fulfilling the disaster response mandate is documented in the Disaster Management Act as well as the National Emergency Management Plan but it is not explicitly communicated hence some confusion exists.

The process for scientific and technical experts to assess and review the accuracy of risk data and information is either not in place or the existence of such mechanism is not publicized. There are no national standards for the systematic collection, sharing and assessment of risk information and data related to hazards, exposures, vulnerabilities and capacities and information readily available to assist with DRR activities.

Resource limitations at NEMO hinder the extent to which review and updating of plans and preparedness and response strategies in the aftermath of hazard events is undertaken.

Assessments do not consider gender, disability, economic diversity, access to infrastructure, societal inequalities and other such vulnerability factors. Hazard mapping includes areas that could be affected but do not include quantification of exposed persons or gender differentiated vulnerability data. Also, the digitization of these maps has not materialized.

Assessment of exposure, vulnerabilities, capacities and risks, and documentation of such does not exist for critical infrastructure/services. Evaluation of potential risks and implementation of risk management solutions to increase resilience of critical infrastructure is lacking.

Roles and responsibilities of stakeholders are documented in the related SOPs but in many cases the agencies are not familiar with the contents of the documents.

Little is known about the functioning and related actions of established monitoring systems as it pertains to specific hazards.

The mandate of the Flood and Drought Committee and how the information it obtains is utilized in decision making is not known.
8.2. DETECTION, MONITORING, ANALYSIS AND FORECASTING OF THE HAZARDS AND POSSIBLE CONSEQUENCES

Important to any EWS is the ability to provide accurate warning services in a timely manner that allows sufficient time for affected communities to activate their disaster plans, and in so doing at least minimize the extent of the negative impact of an event. The MHEWS Checklist makes reference to the importance of a sound scientific basis for such a system and reliable technology for detecting hazards in real-time or near real-time; a forecasting and warning system that operates 24 hours a day, 365 days/year which is monitored and staffed by qualified individuals.\(^9\)

The ideal warning service should have the capacity to handle multi-hazard situations since it is possible for hazardous events to occur in a cascading manner or cumulatively over time. Such characteristic of the system will assure the efficiency and consistency of warnings and contribute to the effective implementation of disaster plans.

An evaluation of this aspect of the disaster management plan for Saint Lucia reveals that there is much progress towards achieving this standard but there are still some areas to be considered and addressed. The key elements considered here are hazard monitoring, hazard forecasting and warning services, and institutional mechanisms to support hazard monitoring, forecasting and warnings.

8.2.1. HAZARD MONITORING

Monitoring systems are in place for specific hazards. The Saint Lucia Meteorological Office has monitoring networks for meteorological hazards. The Seismic Research Centre also has established networks to monitor seismic and volcanic activity in Saint Lucia. A Hydro-meteorological (Hydro-met) network exists throughout the country under the mandate of the national Meteorological Office and the Water Resources Management Agency (WRMA). At present, this network is not standardized as there are different brands with varying functionalities comprising the system. In addition, some stations transmit in real time and can be monitored on the web while others need to be downloaded manually. Nonetheless, this network is monitored and provides some data for analysis and decision making. Under the Disaster Vulnerability Reduction Project (DVRP) a road-map for optimizing the Hydro-met network was established which culminated in a proposed project to rehabilitate the WRMA and Meteorological Office observational Hydro-met network.

In terms of monitoring, processing and disseminating information, this standard seems to be a relative strength of the system as 100% of respondents reported major progress in that regard. Real-time data is
collected by the Meteorological Office and is accessible online. However, the WRMA has the capacity to provide limited real-time data at only one location.

Verification activities regarding monitored data are limited to rainfall values collected from the stations on a monthly basis. The WRMA recognizes the need to characterize the major watersheds according to observed data on the hydrological/hydraulic processes, but this is still in its infancy stage.

8.2.2. HAZARD FORECASTING AND WARNING SERVICES

Forecasting and warning services are in place for weather-related hazards. The Saint Lucia Meteorological Office is the agency responsible for rainfall forecasts. It alerts NEMO and the public regarding the likelihood of extreme weather events. Measurement parameters and specifications are documented for certain hazards. For instance, standard precipitation indices (1 month, 6 months and 12 months) are calculated by the Meteorological Office and compared to monthly hydrological base flows that are calculated by the WRMA. Marine forecasts out to 25 miles (40km) around Saint Lucia are valid for 24 hours and are issued to agencies and the public on a daily basis.

As precipitation/hydrological data become available, these can easily be used as inputs into the current class of modeling tools that are widely used today for enhanced forecasting. The need for strengthening current data collection processes (mainly hydrological) in the field was clearly articulated in an effort to easily use data collected with predictive tools. The numerical modeling software tools in many instances are free for download (freeware).

At the WRMA, software and data analysis for the received data are updated periodically and to high security standards. The computer network is secure comprising of a firewall and sub-networks serving distinct roles for added security. Data made available to the public especially through the WRMA shared website "webmap" is updated periodically. All the data in the system can be verified. Be that as it may, some data gaps exist for what is not currently collected in the field and as such, it is strongly advised that the Agency conducts periodic reviews of the types of analyses it needs to undertake and adjust data collection accordingly.

With respect to warning systems, there is a Flood Early Warning System which utilizes established sirens to disseminate warning to the residents of Castries (Marchand), Anse La Raye and Canaries but, as mentioned previously, these are not CAP compliant. There is also the Dennery Multi-Hazard Early Warning System which utilizes a broader array of dissemination devices to warn the population (emails, smartphone app, radio broadcast interrupt).

When warnings are issued, this is done on a general level. There is no deliberate process established to verify that warnings have reached the principal stakeholders, particularly vulnerable persons and people in vulnerable conditions. Nonetheless, the survey revealed that the population generally takes issued warnings seriously but when the predicted event does not occur this can lead to an attitude of apathy and invincibility. Strategies to build credibility and trust in warnings need to be employed (e.g., understanding difference between forecasts and warnings) without prejudice to who delivers the warning.
There exist mechanisms to inform people when threats and their impacts have ended. That information regarding the “all clear” has been forthcoming from NEMO via various media. Notwithstanding, it was noted that during the 2017 Hurricane Season there was a breach of this protocol when the Government announced that businesses would re-open at a particular time after a ‘shut down’ before the ‘all clear’ status was issued.

### 8.2.3. INSTITUTIONAL MECHANISMS TO SUPPORT HAZARD MONITORING, FORECASTING AND WARNINGS

The Flood and Drought Committee provides general guidance/oversight of the EWS. There is however no dedicated support within the core staff of NEMO for national EWS implementation/expansion, monitoring and routine maintenance.

Institutional support by experts and relevant authorities for monitoring networks is also available through the Seismic Research Centre (SRC) who monitors seismic and volcanic activity in Saint Lucia.

Detailed gaps associated with detection, monitoring, analysis, forecasting and warnings are presented in Table 2.

**Table 2. Detection, Monitoring, Analysis and Forecasting of the Hazards and Possible Gaps**

<table>
<thead>
<tr>
<th>Detection, Monitoring, Analysis and Forecasting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement parameters and specifications are documented only for certain hazards. For instance, standard precipitation indices.</td>
</tr>
<tr>
<td>The WRMA has the capacity to provide limited real-time data at only one location.</td>
</tr>
<tr>
<td>The assigned operation and maintenance budget is not sufficient to assure sustainability of hardware and software. Hence, the WRMA relies on donor funded projects, when available, to make required technical improvements. The hydro-met network is not standardized as there are different brands with varying functionalities comprising the system. Some stations transmit in real time and can be monitored on the web while others need to be downloaded manually.</td>
</tr>
<tr>
<td>Weaknesses exist in the current data collection processes (mainly hydrological) in the field. This must be addressed so that data can be used easily with predictive tools.</td>
</tr>
<tr>
<td>There is no established central repository of event/disaster and risk information for the country. What exists is a database of events.</td>
</tr>
<tr>
<td>There is no deliberate process established to verify that warnings have reached the principal stakeholders, particularly women and people in vulnerable conditions.</td>
</tr>
<tr>
<td>A project to rehabilitate the WRMA and Meteorological Office observational hydro-met network is still in progress.</td>
</tr>
</tbody>
</table>
### Detection, Monitoring, Analysis and Forecasting

<table>
<thead>
<tr>
<th>Coordination among all issuers of information is not formalized. The high operational and maintenance costs have resulted in sustainability issues regarding the consistency of data collection.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The existing Siren System linked to the FEWS is not CAP Compliant.</td>
</tr>
<tr>
<td>The Flood and Drought Committee provides guidance/oversight of the FEWS; however there is no dedicated support within the core staff of NEMO for National EWS implementation, monitoring and routine maintenance.</td>
</tr>
<tr>
<td>Many of the radio stations on the island do not have generators that can keep them on for a long time in the event of a power outage.</td>
</tr>
<tr>
<td>There are no sustainable financing options for response actions. There is limited budgetary allocation for EWS.</td>
</tr>
<tr>
<td>When warnings are issued some people do not take heed for various reasons such as affinity and invincibility.</td>
</tr>
</tbody>
</table>

## 8.3. WARNING DISSEMINATION AND COMMUNICATION

Established communication and dissemination systems serve the purpose of providing advance warnings about impending hazard impacts to people and communities. If successful, this facilitates adequate preparedness and response actions that will safeguard lives and livelihoods and property. This process should involve the utilization of multiple communication channels to ensure that, among other things, the target population is reached. Additionally, the messages must be clear, simple, easily understood and emerge from information sources that are trustworthy. The three (3) components examined here are the Organizational and Decision-Making System, Communication Systems and Equipment and Efficacy of Communication Systems.

### 8.3.1. ORGANIZATIONAL AND DECISION-MAKING SYSTEM

This aspect of disaster management is so critical that functions, roles and responsibilities of all actors in the warning dissemination process should be enforced through government policy or legislation at all levels. Currently, agency actions are guided by the Standing Operating Procedures for the Agencies of NEMO which detail the roles and responsibilities of agencies before, during and after hazard impacts. Specifically, as it relates to information dissemination, upon activation of the National Emergency Operations Centre (NEOC), the National Public Education and Information Management Committee takes over the role of information dissemination and ensures that timely alerts and warning messages are publicized. This
addresses the issues of accuracy and authenticity of information. Prior to activation of the NEOC, this responsibility lies with the NEMO Secretariat.

Response agencies also provide hazard specific information to the public in the face of impending threats. For example, in the case of a threat from a health hazard, the Ministry of Health and Wellness will issue specific alerts to the public. In all cases, agency actions are guided by the National Emergency Management Plan inclusive of policies, legislation and SOPs. Noteworthy however, is the need for MoUs to be established among agencies involved in the dissemination of information. This will allow for early, efficient and effective response to information provided across the spectrum of users.

### 8.3.2. COMMUNICATION SYSTEMS AND EQUIPMENT

A combination of communication and information dissemination systems, including short message service (SMS) messages, emails, press releases, radio and television broadcasts, town criers, public address systems, church bells etc. are currently being utilized to alert the public in Saint Lucia. Dissemination mechanisms also include sirens (capable of transmitting via voice or sounds), smartphone application (CAPCAP) and radio broadcast interrupt. Through the latter, NEMO is able to interrupt programming at three radio stations where an encoder has been installed. Supporting this arrangement is a Memorandum of Understanding (MoU) between NEMO and the radio stations which explicitly states the responsibilities of both parties (NEMO & Radio Station) with respect to the dissemination of warning messages through the Interrupt, as well as care and maintenance of the equipment. Media outlets also voluntarily disseminate early warning information for impending events which may have negative impact at the community, sub-national and national levels. However, despite the presence of a large number of radio stations/media outlets on the island, many of them do not have generators that can keep them on for a long time in the event of a power outage.

Moreover, to support communication and information dissemination at the local level, NEMO has supplied and installed handheld radios for use by all local district disaster committees and provided the requisite training. Through this mechanism, the NEMO Secretariat is able to transmit alerts and warning messages to key stakeholders at the community level for onward transmission/dissemination to the populace. Additionally, with the advent of cell phones and social media platforms such as WhatsApp and Facebook, sending messages have become much faster with a wider reach. However, social media poses a problem when malicious people use available mediums to broadcast fake messages.

Although a variety of communication and dissemination systems is used, it is recognized that insufficient consideration has been given to persons with disabilities and this is a serious gap which must be urgently addressed. Further, although the National Emergency Management Plan, inclusive of SOPs, provides guidance as it relates to agency roles and responsibilities in relation to the dissemination of early warning information, consideration needs to be given to ensuring that the various agencies are aware of these protocols and adhere to them. Another general observation in that regard was that regular coordination, planning and review meetings among the warning issuers and the media are not the norm. Consequently, it was recommended that protocols governing information sharing and communication and warning dissemination arrangements outside of the activation of the NEOC be revisited and improved for greater efficiency.
As it relates to feedback on the outcome of strategies used to communicate with communities, this is sometimes received from field workers who report to their relevant departments. There is certainly a need for structured evaluation of communication strategies to ensure that messages are reaching the population, particularly people in vulnerable conditions. Currently, formal mechanisms are not in place to verify that warnings have been received and to correct potential failures in dissemination and communication. Further, at the community level, there is no established mechanism to verify whether the targeted population understand the information/alerts being disseminated, although based on the way people react it can be assumed that the messages do get across and that people in vulnerable areas/conditions understand the risk that is involved and take the necessary precaution. Some others however, do not take heed for various reasons such as affinity and invincibility.

Mechanisms to update information are in place but their resilience to various events is questionable. Updating of information is based on the unfolding of events. There is reliance on cell phones, ham radios or satellite phones and these have limited use. Cell phones are often rendered inoperable during many events like flooding and hurricanes. Undoubtedly, this may cause a challenge in communicating with the public in a timely manner.

8.3.3. EFFICACY OF IMPACT-BASED EARLY WARNINGS FOR PROMPTING ACTION BY TARGET GROUPS

Although there are public education programs and activities, these need to be continued more rigorously to communicate risks as well as the likely outcome of exposure to the general population. Impact based forecasting is envisaged as the way forward.

Automated systems are not in place to mitigate impacts of events with a short time-frame for reaction (e.g. earthquake - automatic stop of transport, red lights activations in tunnels, stop elevators in closest floor, open fire-truck gates, etc.). Stakeholders saw the benefits but there was no indication that this was included in their respective plans.

Detailed gaps associated with warning dissemination and communication are presented in Table 3.

Table 3. Warning Dissemination and Communication Gaps

<table>
<thead>
<tr>
<th>Warning Dissemination and Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular coordination, planning and review meetings among the warning issuers and the media are not the norm.</td>
</tr>
<tr>
<td>Formal mechanisms are not in place to verify that warnings have been received and to correct potential failures in dissemination and communication. At the community level there is no established mechanism to verify whether recipients receive and understand the information disseminated.</td>
</tr>
</tbody>
</table>
8.4. PREPAREDNESS AND RESPONSE CAPABILITIES

Preparedness and response capabilities are critical elements to consider in disaster management as these are crucial to efficiently and effectively prepare for, respond to, and recover from emergencies and disasters. Adequacy of these two factors will increase individual and community resilience, facilitate operational readiness, improve decision-making during emergency response, and speed the recovery of vital systems and communities. Response activities span the emergency management system, and it is crucial to understand the complexities of response organizations, responders, and their work. Also, people must understand their risks, respect the national warning service and understand how to react to warning messages. This means that education and preparedness programs are essential to secure safe behavior, to reduce risks, protect life and livelihoods and reduce damage and loss to property.

The elements Disaster Preparedness and Response Readiness, Public Awareness and Education Programmes and Public Awareness and Response Testing are considered here.

8.4.1. DISASTER PREPAREDNESS AND RESPONSE READINESS

The existence of response plans developed in a participatory manner and that are well-practiced, tested and frequently reviewed creates an environment of security as it gives rise to a community that is able to respond to warnings through enhanced education on hazards and risks. In many cases where these plans exist, the details may not be known to all residents due to their lack of involvement and seeming lack of interest in community outreach programmes organized by the District Disaster Committees and/or NEMO. Strategies need to be implemented to make the development of plans a participatory activity. A good example is the Comfort Bay Senior Citizens’ Home in Vieux Fort which has considered, perhaps of necessity, the vulnerability of its residents in its disaster management plan. The evacuation plan of this institution, for instance, outlines the sequence for evacuation – the bed-ridden are evacuated first and there exists an understanding with the Southern Taxi Association and certain mini bus drivers to assist with transportation. The establishment of a formal MoU should be considered.
There is increased awareness of the need to ensure that disaster management measures, including response plans, address vulnerabilities and risks but there is still a lot to be done. Progress is slow given the human resource constraints at the NEMO Secretariat. There is also a need for a complete multi-hazard risk assessment exercise and the establishment of a common web portal to host the data/information. Multi-hazard risk assessments data inputted on a common portal (national geographic information system) would enable periodic updating without losing background information. Such a system will allow for evidence-based planning and decision making.

The ability of communities to respond effectively to early warnings must be assessed, particularly vulnerable persons and people in vulnerable conditions. Women have tended to be in the forefront and are more involved in disaster management activities thus enhancing the level of preparedness and ensuring the safety of the family. However, there is still a need to institute strategies to ascertain the level of preparedness of the various communities for various hazards. The presence of the health sector (Community Wellness Centres) within the community disaster groups under the guidance of NEMO, provides an appropriate avenue to receive feedback from vulnerable persons and this should be utilized since no formal system exists for community feedback at present.

Simulation exercises based on likely scenarios and climate projections have been held over the years but it is not certain that those have been based on any scientific research as research activities related to disaster management/disaster risk reduction are very limited. Simulation exercises to test EWS as well as preparedness are also limited owing to the financial state of NEMO. Notwithstanding, such exercises need to be undertaken more regularly to develop a sense of perpetual urgency and preparedness.

As it relates to financial support, it is noted that there are no sustainable financing options for response actions. Overall, there is limited budgetary allocation to NEMO for disaster management activities. The same holds true for EWS in Saint Lucia. To finance emergency response, on an annual basis, NEMO receives Eastern Caribbean $100,000.00 (kept in an imprest account) but for the most part, budgetary allocations are reallocated to support response actions when required.

Training activities are being conducted to build capacity in disaster preparedness but included in these training activities should be strategies to ensure a more sustainable preparedness mode for longer return periods and cascading hazard events. There is need to cater for situations that would require attention for longer periods and for cascading hazard events.

There is an apparent lack of knowledge of existing protocols to evacuate last mile operators (e.g. local police, firefighters, volunteers, health services) who disseminate warnings to the public and decide public measures, including issuing orders for evacuation or shelter-in-place. It is an aspect that should be given serious consideration and addressed in public awareness programmes.

Importantly, community preparedness actions must give serious consideration to accessibility and adequate accommodation at emergency shelters for potential shelterees, and persons at specific institutions and /or those who seek alternative shelter.
8.4.2. PUBLIC AWARENESS AND EDUCATION PROGRAMMES

Disaster Management concepts have not been purposefully integrated into the school curriculum but some basic disaster management concepts are taught as part of the content of subjects such as Social Studies, Environmental Studies and Geography. Although these concepts are not substantially part of the school curricula, schools do have disaster plans and engage in drills especially fire, earthquake, and tsunami drills. Some training is also done with staff and students, and principals and teachers have been exposed to the USAID School Safety Course which prepares them to develop and implement their disaster plans. Presently the Department of Education is considering a curriculum review process and this presents an ideal opportunity to lobby for possible inclusion of some aspects of disaster management in the curriculum.

Ongoing public education is being done by NEMO and local disaster committees through public and town hall meetings, workshops and educational camps. Public service announcements are aired frequently on the radio and television stations and hosts and organizers of some public mass crowd events also sometimes highlight disaster related information. However, these public awareness and education campaigns are general and not specific to particular groups. Public awareness is not tailored in this manner but more to areas where people live, for example, flood prone, landslide prone, areas exposed to sea surge, etc. There is need to target specific vulnerable groups like women, children, older people and people with disabilities. Female headed households should also be included as part of that target group. There is also very limited public education on existing EWS and emergency signage to remind the population of the possible threats and responses and to heighten awareness.

8.4.3. PUBLIC AWARENESS AND RESPONSE TESTING

It is good practice to review and update plans and preparedness and response strategies in the aftermath of hazard events, given lessons to be learnt. It is also good practice to test response plans through simulation exercises and to adjust procedures accordingly. However, this does not always happen given human resource limitations at the NEMO Secretariat, the agency responsible for leading that process.

Additionally, as indicated previously, there are no formal mechanisms in place for gauging public awareness neither are there systems for feedback from communities on issues pertinent to disaster preparedness and response.

Table 4 presents detailed gaps associated with preparedness and response readiness.

<table>
<thead>
<tr>
<th>Preparedness and Response Capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocols to inform people when threats and their impacts have ended are sometimes not adhered to. There are still some issues relating to credibility and trust as it pertains to who issues the warning.</td>
</tr>
<tr>
<td>Response Plan development is not always a participatory activity. Disaster preparedness measures, including response plans, do not always account for the needs of people with vulnerabilities.</td>
</tr>
</tbody>
</table>
Preparedness and Response Capabilities

There is an apparent absence of protocols to evacuate last mile operators.

Disaster Management concepts have not been purposefully integrated into the school curriculum.

The ability of communities to respond effectively to early warnings, particularly women and people in vulnerable conditions is not assessed.

Simulation exercises to test EWS as well as preparedness are limited owing to the financial state of NEMO.

Research activities related to disaster management/disaster risk reduction is very limited.

Training activities do not include strategies to ensure a more sustainable preparedness mode for longer return periods and cascading hazard events.

There is very limited public education on existing EWS. Public awareness and education campaigns do not target specific vulnerable groups like women, children, older people and people with disabilities.

Where SOPs make provisions for debriefing sessions with those involved in post disaster engagements, this is often not adhered to.

There is an absence of emergency signage.

8.5. HAZARD-SPECIFIC GAPS

Further to the gaps presented in the previous sections, hazard-specific gaps were also identified. Hazard-specific gaps are identified for earthquakes, landslides/slope instability, tsunamis, volcanic eruptions, tropical cyclones, floods, droughts and human-induced emergencies. Table 5 details the hazard-specific gaps identified from the application of the MHEWS Checklist.

Table 5. Hazard-specific gaps

<table>
<thead>
<tr>
<th>HAZARD</th>
<th>GAPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earthquakes</td>
<td>Full scale geotechnical investigations and studies have not been done for the determination of the long term stability of regions which have experienced major landslides due to the potential for excessive loss of life.</td>
</tr>
<tr>
<td></td>
<td>Response drills and exercises with first responders and communities are not frequently done.</td>
</tr>
<tr>
<td></td>
<td>Building codes are not strictly adhered to.</td>
</tr>
<tr>
<td>HAZARD</td>
<td>GAPS</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Landslide/Slope Instability</td>
<td>Full scale geotechnical investigations and studies have not been done for determination of long term stability of regions which have experienced major landslides due to the potential for excessive loss of life. Absence of landslide hazard maps and land use plans to guide development control.</td>
</tr>
<tr>
<td>Tsunamis</td>
<td>Response drills and exercises with first responders and communities not frequently done. Need for country preparedness. Communities need to have specific information, for example e.g. possible evacuation routes.</td>
</tr>
<tr>
<td>Volcanic Eruptions</td>
<td>Although communities are aware of the various hazards, they may be unaware of how to address an emergency situation that arises. Drills and exercises with first responders and communities are not done as frequently as they should be. Lack of public awareness.</td>
</tr>
<tr>
<td>Tropical Cyclones</td>
<td>There is an apparent absence of protocols to evacuate last mile operators Absence of strategies to ensure a more sustainable preparedness mode for longer return periods and cascading hazard events.</td>
</tr>
<tr>
<td>Floods</td>
<td>FEWS maps exist only for certain localities and do not specifically address the issue of gender. The Corinth FEWS has not been functional since 2013. The system collects data but does not transmit SMS messages as per design. There is also limited local capacity for assessment and diagnosis of issues and subsequent resolution.</td>
</tr>
<tr>
<td>Droughts</td>
<td>The mandate of the Flood and Drought Committee and how the information obtained is utilized in decision making is not known.</td>
</tr>
<tr>
<td>Human induced</td>
<td>Hazard maps indicating location of chemicals, explosives and other potentially dangerous substances, and activities around watersheds do not exist.</td>
</tr>
</tbody>
</table>
9. Recommendations

9.1 Disaster Risk Knowledge

9.2 Detection, Monitoring, Analysis and Forecasting of the Hazards and Possible Consequences

9.3 Warning Dissemination and Communication

9.4 Preparedness and Response Capabilities
9. RECOMMENDATIONS

The following recommendations are made to help strengthen the EWS in Saint Lucia. A nexus exists at some level between and among some of the various components highlighted in the MHEWS Checklist, hence a particular recommendation may apply to more than one gap, for instance lack of finance. Where this occurs, the recommendation is made only once.

9.1. DISASTER RISK KNOWLEDGE

1. The inadequacy of human resource capacity was highlighted as a factor restricting analysis of characteristics of key hazards that would help guide future action. Training can be provided for a group of volunteers and members of the various district disaster committees who have some of the requisite skills and they can be used to undertake this activity. This training should also include assessing gender differentiated and other vulnerability data.

2. Community hazard maps should be produced for all communities as part of the development of risk management plans at the local level and these should include quantification of exposed persons and gender differentiated vulnerability data. The equal participation of both genders should be a feature of these activities.

3. A policy should be instituted requiring the assessment, documentation and updating of exposure, vulnerabilities, capacities and risk for all critical infrastructure and services.

4. Geotechnical investigations and studies should be undertaken in regions which have experienced major landslides or which are susceptible to such an eventuality with a view to determining the long term stability of these areas.
5. Considerable work has been undertaken to assess vulnerabilities and risks in some of the major economic sectors, Agriculture and Tourism in particular. Similar exercises need to be undertaken in the other sectors.

6. Serious consideration needs to be given to tapping on the knowledge of residents in close proximity to areas where works are being undertaken. Historical and indigenous knowledge go a long way in averting recurrence of events or creation of new hazards and helps save life, livelihoods, infrastructure and money.

7. There is a need for more research to investigate which areas are vulnerable to which hazards and to assess the potential extent of damage, based on extrapolations of historically available data and indigenous knowledge. This is imperative since developments are constantly occurring and associated infrastructure is on the rise.

8. The existence of legislation is very important in Disaster Management. As such, it is prudent that existing legislation be assessed with a view to identifying gaps that may facilitate increased vulnerability of persons and communities and where necessary, to lobby for the relevant amendments to be instituted.

9. The updated Comprehensive Disaster Management Legislation needs to be ratified. The review was done in 2014 so this may require another round of revision. The draft regulations to accompany the Comprehensive Disaster Management Act also need to be ratified. The status of NEMO as the coordinating agency responsible for coordinating hazard identification and risk information must be explicitly communicated.

10. Studies and assessments geared towards poverty reduction should include factors associated with the occurrence of various hazard events as these are closely linked.

11. The process for scientific and technical experts to assess and review the accuracy of risk data and information developed needs to be established or if in existence, publicized as respondents were unilateral in their claim that this was not in place.

12. There is a need to map the presence of resources of all relevant agencies (including security forces) and to ascertain that the SOPs define their roles and responsibilities in an emergency, based on their existing resources for effective dissemination of information.

13. A standard repository of event/disaster and risk information should be established as well as national standards for the systematic collection, sharing and assessment of risk information and data related to hazards, exposures, vulnerabilities and capacities to assist with DRR activities.

14. NEMO and other agencies should continue to lobby government and elsewhere to address budgetary constraints that hinder efforts to assure sustainability of requisite hardware and software.

15. Hazard maps indicating location of chemicals, explosives and other potentially dangerous substances, and activities around watersheds should be produced and made available to relevant agencies, e.g.
9.2. DETECTION, MONITORING, ANALYSIS AND FORECASTING OF THE HAZARDS AND POSSIBLE CONSEQUENCES

1. EWS equipment needs to be evaluated on a regular basis and local capacity for assessment and diagnosis of issues and subsequent resolution developed to ensure that they are functional. Existing FEWS in Corinth and Dennery should be checked and tested regularly and consideration should be given to installing same in other areas which have been affected extensively in the past. E.g. Vieux Fort and Soufriere.

2. To ensure the sustainability of the existing hardware and software associated with the EWS, NEMO, the WRMA and other agencies should seek funds from donor agencies in the form of projects. This will assist in addressing the paucity of resources available for maintenance. Additionally, efforts should be made to establish links with research departments of educational institutions within and outside the region to have their students engage in related research projects on the EWS and funded by them.

9.3. WARNING DISSEMINATION AND COMMUNICATION

1. There is need to ensure that protocols and policies are adhered to as it pertains to all aspects of disaster management including dissemination of information. Media outlets have had a tendency to sensationalize news. Broadcasters should be trained on how to communicate early warnings so that panic can be avoided.

2. Although communities are aware of the various hazards, they may be unaware of how to address an emergency situation when it arises. It is important that communities be trained in basic emergency response, such as how to evacuate and evacuation routes, understanding messages issued by NEMO and different categories of threat and how they should respond to them.

3. Traditional methods of warning dissemination should be explored for greater reach.
4. Consideration needs to be given to educating people on how to react in situations in which events with a short time-frame for reaction occur.

5. Protocols need to be established and communicated to evacuate last mile operators (e.g. local police, firefighters, volunteers, health services) who disseminate warnings to the public and decide public measures, including issuing orders for evacuation or shelter-in-place.

6. Attempts should be made to provide training to ensure that there is local capacity for assessment and diagnosis of issues and subsequent resolution as they pertain to the FEWS. This would aid in resolving, for instance, the Corinth FEWS which collects data but does not transmit SMS messages as per design.

7. There is a need to address the manner of dissemination of information in relation to impending events/disasters. There is a structure in place that guides all actors involved but because individuals are obtaining information from various sources and disseminating these as well, it creates an issue that needs to be dealt with.

9.4. PREPAREDNESS AND RESPONSE CAPABILITIES

1. Drills and exercises are being conducted with first responders and communities but there is need for more of those at the community and institutional level for greater and more effective response when the real situation occurs.

2. It is recommended that the authorities establish a land use management system that disseminates knowledge on land use and discourages settlement in remote locations that cannot be easily accessed, especially in emergencies and in areas prone to specific hazardous events.

3. It is apparent that the components of EWS are being implemented in a piecemeal manner. Consideration should be given to the design of an Integrated National EWS System for Saint Lucia.

4. Conduct an extensive public education campaign on existing EWS for maximum effectiveness of the system to address the apparent limited public education on existing EWS.

5. Legally mandate television and radio stations to support broadcast interrupts from CAP. Currently, this exists with three (3) media houses as a voluntary arrangement. That stipulation can be established as a requirement for registration.

6. Consideration needs to be given to the establishment of relevant interventions for volunteers after engagements. Debriefing sessions should be arranged on completion of assignments as some of the experiences can be rather harrowing.

7. Emergency signage should be erected at various locations to remind the population of the possible hazards and response actions, and to heighten their awareness. For example, on the beaches.
10. Conclusion
To be effective, early warning systems must be people-centered and must integrate four elements. Failure in any one of these elements can mean failure of the entire early warning system. Much progress has been made in developing the knowledge and technical tools required to assess risks and to generate and communicate predictions and warnings, particularly as a result of growing scientific understanding and the use of modern information and communication technologies. However, some of our experiences point to significant inadequacies in our existing early warning systems.

This survey revealed that our warning systems lack the basic capacities of equipment, skills and resources resulting in many gaps and shortcomings. Progress on each of the above four components of people-centered early warning systems is mixed, but special attention needs to be placed on warning dissemination and preparedness to act. Warnings may fail to reach those who must take action and may not be understood or address their concerns. The gaps identified show the need for greater political commitment, stronger coordination among the various actors and greater public awareness and public participation in the development and operation of early warning systems.

10. CONCLUSION
11. REFERENCES
11. REFERENCES


3. GOSL. n.d. Draft Comprehensive Disaster Management (Early Warning Systems) Regulations. Castries, Saint Lucia: GOSL


   - Inception meeting on Thursday 26 November 2015. Castries, Saint Lucia: NEMO


