

Sector	Coastal Zone and Low-Lying Communities
Subsector/ Category	Extreme weather events (Flood & Drought Management)
Technology	National Early Warning Systems (EWS) (Flood & Drought)
Scale of Application	National scale
Availability	A fully functional and integrated formal system is not yet available or operational in Guyana. Response action to disasters is coordinated by the CDC. To date, much work has been completed to support the establishment of an integrated EWS in Guyana, such as, the preparation of the following: A EWS Framework (2013), a National Integrated Disaster Risk Management Plan & Implementation Strategy (2013), A Multi-Hazard Preparedness and Response Plan (2013), An EWS Study – Situation Report (2009), A Draft EWS Protocol for Drought (2015), A National Adaptation Strategy & Action Plan for the Agriculture sector (2009) and recently, in December 2015, the CDC launched a National Emergency Monitoring System. EWS can be formal with readily visible structures that are part of the national government bureaucracy or they can be informal aspects of local, cultural traditions. Currently, EWS in operation covers most types of natural hazards, conflict, ecological changes, health-related and complex humanitarian crises (CDC, 2013)
Technology Characteristics	
Introduction Sea-level rise from climate change is projected by more than 1 m by 2100. The coastal region is most vulnerable from sea level rise and extreme weather events since it houses over 90% of the population, along with the country's major infrastructure and economic zones (SNC, 2012). Climate change and extreme weather events, due to their severity and frequency, will exacerbate the country's vulnerability. A number of studies were conducted over the years and these concluded Guyana is exposed to the following disaster risks/ hazards /treats (i) flooding as a result of excessive rainfall, (ii) coastal flooding as a result of breached levees and over-topping of the seawall, (iii) drought from reduced rainfall over an extended period, (iv) intense storms and high wind-speeds affecting people and property, and (v) risks of wild fires (due to excessive dry periods) (GLSC, 2010 & Cummings (not dated). Already, the country is experiencing the impacts of extreme weather events such as floods due to increased and intense precipitation and low annual and seasonal rainfall resulting in drought-like conditions. The major flood of 2005 affected approximately 275,000 people, killed 34 and cost the country approximately USD 465M (ECLAC, 2005; Cummings, not dated). The major drought of 1997 affected approximately 607,200 people and caused the country USD 29M (Cummings, not dated). Findings showed that information was not disseminated to communities and general warning systems were inadequate to inform the public of the threat and the extent of the disaster and, as a result, the impacted population was caught off-guard (ECLAC, 2005). Early warning system (EWS) is a critical component of a country's disaster risk reduction strategy and adaptation framework and allows for the provision of timely and reliable information in advance of the occurrence of a disaster to adequately plan and safeguard lives and livelihoods. EWS goes beyond the use of technology for monitoring, prediction and dissemination of information. It is an established system that provides advance information of possible hazards and encompasses components to manage risks and mitigate losses through planned measures and response actions (CDC, 2013). This technology application in Guyana is focused on a national-scale EWS for flooding and drought as a component of the country's climate change adaptation strategy. It takes into consideration that a fully functional EWS must be able to	

forecast a number of climatic and weather related events across different temporal scales. The warning must be timely to allow for planning and response, reliable and simple to understand (Grasso,V, 2012). The national studies conducted in Guyana to establish an early warning system present the four (4) elements as (GLSC, 2010): (i) Monitoring & Warning – technical hazard monitoring and warning service; (ii) Dissemination and Communication – communicate risk information and warnings timely and appropriately; (iii) Preparedness and Response – national (and community) preparedness and response capabilities; and (iv) Knowledge - understand the hazard, vulnerability and risks through assessments and data collection and information preparation.	
Institutional/Organizational	The Civil Defence Commission (CDC) has the responsibility prepare, coordinate and respond to all types of disaster in Guyana. Other collaborating institutions are, National Drainage and Irrigation Authority, Sea and River Defence Division, Environmental Protection Agency, Hydrometeorological Service. As it relates to the elements of an EWS, a number of institutions have specific responsibilities and these are: (i) Monitoring and warning - Hydrometeorological Service; (ii) Communication and dissemination - Government Information Agency (GINA) in collaboration with other media houses; (iii) Preparedness and response – CDC in collaboration with other agencies; (iv) Knowledge of hazard, vulnerability & risks as well as data collection – Environmental Protection Agency, Guyana Lands and Surveys Commission, Bureau of Statistics, Guyana Red Cross, Hydrometeorological Service, Guyana Water Inc.
Adequacy for Current Climate	The national policy environment in Guyana favors the formal establishment of an EWS as new institutions are not required. A formal system enables effective planning, collaboration and coordination among the responsible institutions and build synergies for the optimization of resources to allow the country to effectively adapt to climate variability and future climate change.
Size of Potential Beneficiary	The direct beneficiaries are ‘at risk’ communities in the vulnerable areas, however, the entire country and all sectors would also benefit from the implementation of a national scale EWS.
Disadvantages	• Monitoring of slow-onset hazards such as droughts could be a challenge in the absence of advance technology and improved knowledge; • High costs associated with implementation and maintenance of the system, especially to monitor drought conditions; • Skills and capacity to analyze the information; and • Public perception, behaviour and response to warnings could impact the functioning of the system.
Endorsement by experts	EWS is fully endorsed by national and international experts. EWS as defined by the United Nations states that “EWS is a set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm and loss⁷” (UN ISDR, 2009).

⁷ <http://www.preventionweb.net/english/professional/terminology/v.php?id=478>

Capital Costs	
Cost to implement/Operate/Maintain	<i>Implementation:</i> - There is no single institution to oversee and manage EWS. The Hydrometeorological Service provides all weather-related data to the CDC and other stakeholders. The CDC oversees disaster response and collaborates and coordinates with responsible institutions. The implementation of a national scale EWS will incur high costs, including, strengthening the capacity of the Hydromet Service, consultancy services, training in EWS response techniques, equipment for data collection, communication, networking and transport. <i>Operation/ Maintenance:</i> - Effective functioning of networking and communication systems; and - Ongoing training/capacity building in response measures.
Development Benefits – direct/indirect benefits	
Adaptation benefits	Contributes to reduction of vulnerability to climate change and extreme weather events and increased climate resilience of the country through the provision of timely information to critical stakeholders.
Economic benefits	- Reduces overall national expenditure on climate related disasters; - Reduce impacts and economic losses at the household level due to early warning; - Allow for interventions to reduce the impact of flooding and droughts in advance of the event; and - Increase employment opportunities and provision of local skills in range of disciplines to support the operation and maintenance of EWS.
Social benefits	- Minimize risks to life and livelihoods and allows for early evacuation of vulnerable groups; - Timely dissemination of information through EWS to 'at risk' population and sectors enable stakeholders to plan activities to reduce losses and risks and safeguard income; and - Reduce impacts on health and the spread of diseases, especially during flooding.
Environmental benefits	- A fully functional EWS will provide information to contribute to environmentally sustainable development; and - Allows for a reduction of impacts on the environment associated with flooding.
Local Context	
Status of Technology	A formal early warning system is not yet operational in Guyana. To-date a number of studies were conducted by the CDC and the GLSC to understand Guyana's context and requirements for the establishment of EWS in the country, as well as, how the system could function as part of its national disaster risk reduction approach. Elements of EWS such as meteorological observations, forecasting and to some extent dissemination of information exist, albeit, there is limited capacity to make future projections. The use of geographic information system and remote sensing, satellite images, flood forecasting system to adequately monitor and predict hazard events are not yet in use (CDC, 2013; GLSC, 2010).

Market potential	This technology widely available and applied in many countries. A significant market exists locally for the provision and application of equipment for monitoring, mapping and modeling and dissemination of information.
Acceptability to stakeholders	All groups of stakeholders are affected greatly by natural disaster in Guyana, and view this technology as critically needed. Recognizing the impact on the agriculture sector can have a crippling effect on the economy, farmers will readily embrace the implementation of an EWS.
Opportunities and Barriers	<i>Opportunities:</i> • Promote institutional strengthening for roles and responsibilities of each component of the EWS; and • Generate wider national interest/involvement in disaster preparedness; <i>Barriers:</i> • Lack of specific legislation and legal framework to address disaster preparedness and response planning, in general, and specific to EWS; • The absence of a formal system of early warning leads to insufficient coordination, participation, investment and lack of clarity of roles and responsibilities (duplication of roles and responsibilities); and • Lack of adequately trained personnel to support the implementation of EWS and use of hardware/software.
Time Frame	Short to medium term
References: 1. Civil Defence Commission & United Nations Development Programme,(2013): Early Warning Systems Framework 2. Cummings, G. (not dated): Early Warning System in Guyana. Hydrometeorological Service. Ministry of Agriculture. 3. Decentralized community-run Early Warning Systems. http://www.climatetechwiki.org/content/decentralised-community-run-early-warning-systems 4. Economic Commission for Latin America and the Caribbean (ECLAC) (2005): Guyana – Socio Economic Assessment of the damages and losses caused by the January – February 2005 flooding. 5. Government of Guyana, (2012): Guyana Second National Communication to the United Nations Framework Convention on Climate Change. 6. Grasso, Veronica. (2012): <i>Early Warning Systems: State-of-Art Analysis and Future Directions (Draft)</i>. United Nations Environment Programme. Available at: http://na.unep.net/geas/docs/Early Warning System Report.pdf 7. Guyana Lands & Surveys Commission, (2010): Early Warning System Study.	