



# **Guyana's National Drought Mitigation and Adaptation Plan United Nations Convention to Combat Desertification (UNCCD) Drought Initiative**



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United Nations Convention to Combat Desertification**

**Co-operative Republic of Guyana  
Guyana Lands and Surveys Commission**

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## ACRONYMS AND ABBREVIATIONS

CARiDRO	Caribbean Assessment Regional Drought
CARDI	Caribbean Agricultural Research & Development Institute
CARIWIN	Caribbean Water Initiative
CariCOF	Caribbean Climate Outlook Forum
CCCES	Caribbean Centre for Climate and Environmental Simulations
CDC	Civil Defence Commission
CDEMA	Caribbean Disaster Emergency Management Agency
CDPMN	Caribbean Drought and Precipitation Monitoring Network
CH&PA	Central Housing and Planning Authority
CIMH	Caribbean Institute for Meteorology and Hydrology
CM	Continuous Months
CMO	Caribbean Meteorological Organization
COP	Conference of Parties
CPT	Climate Predictability Tool
CPTEC	Centre for Weather Forecasting and Climate Research
CRIC	Committee for the Review of the Implementation of the Convention
CRSAP	Climate Resilience Strategy and Action Plan
CRU	Climate Research Unit
DANA	Damage Assessment and Needs Analysis
DEI	Disaster Exposure Index
DEWS	Drought Early Warning System
DRM	Disaster Risk Management
EDWC	East Demerara Water Conservancy
ENSO	El Niño-Southern Oscillation
EPA	Environmental Protection Agency
EWS	Early Warning System
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GEA	Guyana Energy Agency
GINA	Government Information Agency
GLSC	Guyana Lands and Surveys Commission
GLDA	Guyana Livestock and Development Authority
GoG	Government of Guyana
GRDB	Guyana Rice Development Board
GSDS	Green State Development Strategy: Vision 2040
GuySuCo	Guyana Sugar Corporation Inc.
GWl	Guyana Water Incorporated
HDI	Human Development Index
ICT	Information and Communication Technologies
IDB	Inter-American Development Bank
IDRM	Integrated Disaster Risk Management
INCD	Intergovernmental Negotiating Committee
INPE	National Institute for Space Research



IPCC	Intergovernmental Panel on Climate Change
ITCZ	Inter-Tropical Convergence Zone
IWG	Intergovernmental Working Group on Drought
IWRM	Integrated Water Resource Management
LDN	Land Degradation Neutrality
MBT	Months Below Threshold
MDGs	Millennium Development Goals
MOA	Ministry of Agriculture
NAP	National Action Plan
NAREI	National Agricultural Research and Extension Institute
NCCPAP	National Climate Change Policy and Action Plan
NDIA	National Drainage & Irrigation Authority
NDMAP	National Drought Mitigation and Adaptation Plan
NDRRCP	National Disaster Risk Reduction Coordination Platform
NDE	Number of Droughts Events
NGO	Non-Governmental Organization
NMHDPRP	National Multi-Hazard Disaster Preparedness and Response Plan
NIDRMP	National Integrated Disaster Risk Management Plan
NOAA	National Oceanic and Atmospheric Administration
OCC	Office of Climate Change
PAHO	Pan American Health Organization
PISCA	Participatory Integrated Climate Services of Agriculture
RCPs	Regional Concentration Pathways
RDC	Regional Democratic Council
RLWS	Rehabilitated Linden Water System
SDGs	Sustainable Development Goals
SLM	Sustainable Land Management
SNC	Second National Communication
SOs	Specific Objectives
SPI	Standardised Precipitation Index
SRDD	Sea and River Defence Department
TANA	Technology Adaptation Needs Assessment
TNC	Third National Communication
UN	United Nations
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
USDM	U.S. Drought Monitor
WMO	World Meteorological Organization
WUA	Water Users Association

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- Guyana Fire Service
- Guyana Livestock Development Authority
- Guyana Red Cross Society
- Guyana Sugar Corporation Inc.
- Guyana Water Inc.
- Hydrometeorological Service
- Ministry of Public Health
- Mahaica Mahaicony Abary - Agriculture Development Authority
- National Agricultural Research and Extension Institute
- National Drainage and Irrigation Authority
- Office of Climate Change
- Pan-America Health Organisation /World Health Organisation
- United Nations Development Programme
- United Nations Food and Agriculture Organisation of the United Nations

Many thanks are also extended to the National Focal Point to the UNCCD - the Guyana Lands and Surveys Commission- and the UNCCD Secretariat for their kind participation in the review, update, and finalisation of this Plan.

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## EXECUTIVE SUMMARY

Drought is a prolonged dry period in the natural climate cycle that can occur anywhere in the world. This sort of prolonged dry period has dire significant direct and indirect effects on human and natural systems. Additionally, the US National Drought Mitigation Centre refers to drought as a protracted period of deficient precipitation resulting in extensive damage to crops, and a consequential loss of yield. Therefore, in the absence of a universal definition for drought, the national context has to be considered in the quest to streamline activities to combat drought. The four major types of drought that are generally recognized are Meteorological, Agricultural, Hydrological, and Socio-economic. The IPCC reports that climate change is projected to increase the frequency, intensity, and duration of droughts, with impacts on many sectors, in particularly food, water and energy.

Historically, the Government of Guyana has responded to different hazards in a reactive way, with an emphasis on humanitarian action and recovery. There have been many attempts thus far to address disaster risk as a cross-cutting development issue that can support the achievement of the national strategic development goals and reinforce community resilience. Guyana's experience of droughts dating back to 1997-1998 and more recently in 2009-2010 and 2015, showed varying impacts from year to year and also across the country. These impacts ranged from loss of crops, increased poverty, loss of animals, reduced surface water availability (creeks, ponds), increased urban migration and reduced national economic performance.

At UNCCD COP-13, the UNCCD institutions and bodies were requested to implement Drought Initiative in the biennium 2018-19 at national level. This request resonated with increased calls from Country Parties during CRIC17 held in Guyana, for support from the UNCCD to develop National Drought Plans. More so, the UNCCD COP-14 also requested further extension of the Drought Initiative in the biennium 2020-21. The goal is to promote a paradigm shift in approach to the way drought is managed – from a reactive and crisis-based towards a proactive and risk-based one. The preparation of this document was funded by the UNCCD to meet request of the above, with the main goal of achieving the greatest public benefit for domestic water use and sanitation in an efficient and equitable manner during severe dry periods such that there is sustainable economic, social and environmental development.

Guyana's National Drought Mitigation and Adaptation Plan consist of ten chapters: Chapter 1- background- presents the purpose, objectives, guiding principles and scope of the plan and defines the concept of drought. It also defines the process of designing the National Level Plan of Action. Chapter 2- overview of drought in Guyana- provides a brief country overview and describes the key events, issues, and potential impacts of drought in the country. Chapter 3- relationship to other policies, plans, and strategies- provides an appraisal of national policies, strategies and plans in relation to drought mitigation and adaptation in Guyana. Chapter 4- drought impacts on specific sectors- provides insights on the effects of drought on sectors that support livelihoods. Chapter 5- institutional landscape for drought management- provides an overview of agencies with direct or indirect responsibility for drought management in Guyana. Chapter 6- drought monitoring, forecasting, and impact assessment- enumerates the processes needed to understand and monitor drought incidents, including the development and use of indicators. Chapter 7- drought risk and vulnerability- provides an assessment of

the risks and vulnerability associated with droughts to inform decision-makers and communities in devising measures that reduce and prevent the worst impacts of droughts. Chapter 8- drought communication and response actions- enumerates the drought protocol for timely dissemination of information for decision makers to take measures to mitigate the impact of drought. Chapter 9- drought mitigation, preparedness, and adaptation- describes the measures needed for increasing drought preparedness and mitigating and adapting to its short-term and long-term effects. Chapter 10- implementation actions recommended highlights some of the administrative steps within the ambits of a governance framework that need to be taken to operationalise the plan. It includes a strategy for capacity development and gender mainstreaming, which are essential components of effective drought monitoring, preparedness, mitigation and adaptation.

Overall, the ten chapters of the report present general guidelines for developing drought preparedness, and planning and managing actions for monitoring, impact prediction and assessment, mitigation and adaptation. These steps will guide the planning of response actions in advance, and highlight the importance of appropriate policies, effective information management and early warning, and effective communication and networking between and among key stakeholders. Furthermore, the plan promotes a more proactive and anticipatory approach to drought management, and emphasises the need to learn lessons from previous efforts to manage related risks and impacts while documenting, evaluating, and sharing information at multiple levels. Consequently, the effective application of the measures recommended in this plan will help sectors to establish clear and objective thresholds for drought management, develop appropriate indicators for monitoring and evaluation, link management plans to wider national and subnational strategies and policies for environmental governance and sustainable development, and establish appropriate institutional structures and organisational networks.

A comprehensive planning process that is gender responsive is adopted in formulating this plan and recommended for implementation. The steps are: Meet with UNCCD Focal Point Agency; Comprehensive Literature Review; Revision; Stakeholder Validation Workshop; Approval Process; Implement the Plan; and Carry out Post Drought Evaluation. It is important to emphasize that the guiding principles of this plan that speaks to preparedness, scientific assessments, timely decision-making, effective stakeholder participation, flexibility, effective information management, monitoring and communication, are key tenets for the prevention, mitigation and management of drought and its impacts. The steps in the planning process therefore form part of an integrated planning process rather than a list of discrete tasks under the leadership of the Guyana Lands and Surveys Commission (Focal Point Agency to the UNCCD) and the Drought Committee.

Guyana's National Drought Mitigation and Adaptation Plan made use of the lessons learned from all previous work on combating land degradation in the country and good experiences from neighbouring states in the Caribbean. The plan is aligned with the overarching Green State Development Strategy: Vision 2040 and accommodates aspects of watershed management, water harvesting modalities, water conservation practices, women participation and engagement, livestock and agriculture management, and drinking water distribution. Science and technology have important roles to play in mitigating the effects of drought. Post drought evaluation is also central in proactive drought management. Its objective is to examine systematically the elements of success and failure in the implementation of the

plan and take advantage of lessons learnt to make better plans for the future. This would be done by studying and documenting impacts of drought occurrences as well as providing necessary adjustment for future occurrences. The evaluation exercise would carefully consider recommendations on how to improve the appropriateness of each aspect of the drought plan.

#### **Priority implementation actions**

- ✚ Accelerate process to transform DRM Bill into law
- ✚ National dialogue on drought to clearly define stakeholder agencies roles and responsibilities with regard to drought monitoring
- ✚ Strengthen institutional capability of the CDC

#### ***Drought Monitoring and Forecasting Recommendations***

- ✚ Strengthen data infrastructure (GIS capability in drought mitigation and response) and management system
- ✚ Standardize data collection and set up additional automatic weather stations

#### ***Drought Impact Assessment Recommendations***

- ✚ Enhance capacity of staff of the Hydrometeorological Service

#### ***Drought Risk and Vulnerability Assessment Recommendations***

- ✚ Conduct drought vulnerability assessment at regional level
- ✚ Identify and integrate gender-based differences and issues in the design and implementation
- ✚ Establish Regional Risk Management Team to operationalize the existing DRM Plan

#### ***Drought Communication and Response Recommendations***

- ✚ Institutionalize drought protocol and implement effective DEWS approach
- ✚ Enhance drought communication, education and awareness to target specific social groups, including farmers
- ✚ Strengthen forecasting capability and EWS technology

#### ***Drought Mitigation and Preparedness Recommendations***

- ✚ Integrate drought initiatives in all climate dependent/related sectors
- ✚ Promote greater institutional collaboration, including the private sector
- ✚ Strengthen drought preparedness and extension systems nationally
- ✚ Conduct curriculum review and update same to educate students on drought responses
- ✚ Increase access to financial resources to establish disaster risk funds

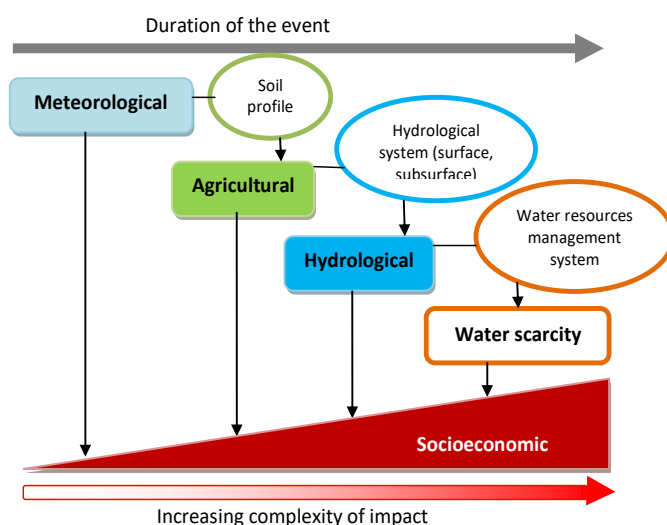
**Review the National Drought Mitigation and Adaptation Plan every five years**

## CHAPTER 1 BACKGROUND: SETTING THE CONTEXT

### 1.1 Introduction

Droughts are recurring slow-onset hazards that can have dire significant direct and indirect effects on human and natural systems, including terrestrial and fresh water ecosystems, forest and agricultural systems, public health, surface water supply, food security, energy, or economies that are linked to tourism and transport (Schwalm *et al*, 2017). According to the World Meteorological Organization, drought is a prolonged dry period in the natural climate cycle that can occur anywhere in the world. Additionally, the US National Drought Mitigation Centre refers to drought as a protracted period of deficient precipitation resulting in extensive damage to crops, and a consequential loss of yield. Therefore, in the absence of a universal definition for drought, the national context has to be considered in the quest to streamline activities to combat drought. In fact, a single year of drought can undermine years of social development, in particular for vulnerable members of society. Globally, water scarcity alone could cost some regions up to six percent of their Gross Domestic Product (GDP) by 2050, in turn triggering mass migration and conflict over diminishing resources. In Guyana, the impact of drought on the agricultural sector was estimated at 31.4 % of the GDP (Trotman and Farrell, 2010); hence the ultimate goal of a drought plan is to achieve the greatest public benefit for domestic water use and sanitation in an efficient and equitable manner during severe dry periods such that there is sustainable economic, social and environmental development.

*There are four types of droughts (see Figure 1). Meteorological drought refers to precipitation deficits, agricultural drought refers to abnormally low soil moisture, hydrological droughts reflect below-average water levels in lakes, rivers and streams, and socioeconomic drought refers to when the demand for an economic good exceeds supply due to a weather-related shortfall in water supply (Wilhite and Glantz, 1985 and DMEWSP, 2015:10).*



**Figure 1: Types of Droughts**

Source: Protocol for Drought Early Warning System. Guyana

For instance, when drought persists, the water supply system (for example, dams, tanks, ponds, lakes, and reservoirs) cannot sustain important water demands; then water scarcity sets in. This would have socioeconomic implications for Guyana.

Droughts are generally associated with longer term climatic variability; in Guyana’s case, droughts are most often induced by El Niño Southern Oscillation. Table 1 provides details drought occurrences between 1987 and 2010.

**Table 1: Droughts in Guyana and Relation to El Niño**

<b>DROUGHT</b>	<b>PACIFIC OCEAN</b>
Mar 1987	El Niño
Jan 1988	El Niño
Oct 1997	Severe El Niño
Apr 2003	Immediately after El Niño
Sep 2006	El Niño
Feb 2007	Immediately after El Niño
Nov 2009	El Niño
Jan 2010	El Niño

Source: Desinventar and NOAA

The Inter-American Development Bank (IDB) Disaster Exposure Index (DEI)<sup>i</sup> identifies Guyana as the fourth most exposed country in the Latin American and Caribbean region to natural disasters. This is primarily the result of the country’s high exposure to and experience of flooding as well as drought. Guyana’s DEI score, 0.60 on a scale of 1.00, is particularly high given that the country is not significantly exposed to tropical storms, is not on the Caribbean hurricane belt, and also has no significant earthquake or volcano risk (Climate Resilience Strategy and Action Plan, 2016).

## 1.2 The Drought Initiative<sup>1</sup>

In recent years, attention towards enhancing drought preparedness has increased as seen in movements such as a High-level Meeting on National Drought Policy held in Geneva; an UN-water initiative of capacity building regional workshops to support the development of national drought policies, and the development and adoption of the United Nations Sendai Framework for Disaster Risk Reduction 2015-2030. Against this backdrop, the 13th United Nations Convention to Combat Desertification (referred to as the UNCCD) Conference of Parties (Decision 29/COP13) requested the secretariat and appropriate UNCCD institutions and bodies (including the Science-Policy Interface) within their respective mandates to implement Drought Initiative in the biennium 2018-19. This request resonated with increased calls from Country Parties during the Seventeenth Sessions of the Committee for the Review of the Implementation of the Convention (CRIC17) held in Guyana, for support from the UNCCD to develop National Drought Plans. More so, the UNCCD COP-14 (Decision 23/COP14) also requested further extension of the implementation of the Drought Initiative in the biennium 2020-21.

<sup>1</sup> Information taken from the Terms of Reference prepared by the UNCCD Secretariat.  
<https://www.unccd.int/convention/about-convention>

The key purpose of the Drought Initiative is to enhance the resilience of communities and ecosystems to drought by developing national action plans. The goal is to promote a paradigm shift in approach to the way drought is managed – from a reactive and crisis-based towards a proactive and risk-based one.

Important, the Drought Initiative is aligned with national initiatives as outlined below.

- (a) Enhancing Climate Resilience in the Water Sector it relates to Droughts through rainwater harvesting, water conservation techniques, integrated water resources management, incorporation of climate change in infrastructure planning, awareness raising, and establishment of a climate monitoring system, which allows predicting events such as the El Nino Southern Oscillation, among others.
- (b) Achieving Land Degradation Neutrality: for example, Target 15:3 aims by 2030 to combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation neutral world. Undoubtedly, land degradation and water scarcity are inextricably linked; as such any initiative aimed at restoring degraded lands will improve the natural capacity to store and filter water<sup>2</sup>.
- (c) Achieving specific Aichi targets<sup>3</sup> such as Goal C, Target 11: Guyana will establish more legally protected areas and conduct ecological management and build capacity for planning, establishment and management of Protected Areas (also Watershed) (Guyana's Fifth National Report to the Convention on Biological Diversity covers the period 2011 to 2014).

It is therefore within this context that Guyana's National Drought Mitigation and Adaptation Plan has been prepared.

### 1.3 Purpose, Objectives, Guiding Principles and Scope of the National Drought Mitigation and Adaptation Plan

#### **Purpose**

The purpose of the National Drought Mitigation and Adaptation Plan (hereafter referred to as the NDMAP) is to facilitate proactive, coordinated, and effective planning, preparedness, mitigation, adaptation, response, and recovery activities in Guyana in response to drought risks and impacts.

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<sup>2</sup> See [atologue.unccd.int/1442\\_LDN\\_Water\\_Security\\_drought\\_report%20Web.pdf](http://atologue.unccd.int/1442_LDN_Water_Security_drought_report%20Web.pdf).

<sup>3</sup> Protected Areas Act passed in 2011, established the PAC, and the NPAS. The passage of the Act was followed by the legal establishment of two new protected areas - the Kanuku Mountains and Shell Beach. These areas join the existing Kaieteur National Park and Iwokrama Rainforest Reserve, and the Community Owned Conservation Area at Konashen, which together account for approximately 8.6% of Guyana's landmass. The system also includes the National Park, Zoological Park and the Botanical Gardens. This puts Guyana on course for achieving the target of having at least 17 per cent of land and inland water under some form of protection by 2020.



## Scope

The NDMAP will focus on three key pillars: implement drought monitoring and early warning system; assessment of drought vulnerability and risk; and implement measures to limit impacts of drought and better response to drought. The scope of the NDMAP is as follows:

- Outline of the process of designing national level plan of action;
- Overview of Guyana and Drought Issues;
- Appraisal of national policies, strategies and plans in relation to drought mitigation and adaptation in Guyana;
- An assessment of drought impacts on specific sectors in Guyana;
- Review of the institutional landscape for drought management in Guyana;
- Examination of issues related to drought monitoring, forecasting, and impact assessment;
- Provision of a framework for identifying the human, social, economic, political, physical, and environmental causes of drought impacts;
- Outline of the drought communication and response actions;
- Analysis of the national drought mitigation, preparedness and adaptation measures; and
- Presentation of priority recommended actions.

Specific attention is given to (a) What the country needs to do to assess and minimize the adverse effects before, during and after the drought; (b) How Guyana will monitor affected segments of the populations and communicate with the stakeholders, and the nation at large about expected or ongoing drought; and last, but not least, (c) What the country will need to do after the drought to reduce future impacts, including the review of actions before and during drought, as well as the effectiveness of the NDMAP<sup>4</sup>.

## Objectives

The following objectives of the NDMAP reflect Guyana's unique physical, socio-political, environmental and economic characteristics:

- i. To collect, analyse drought related data in a timely and systematic manner;
- ii. To establish criteria for monitoring and tracking drought emergencies and activate coordinated mitigation and response activities;
- iii. To provide an organisational structure and delivery system that ensure information flow between levels of government (central and regional);

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<sup>4</sup> See <https://knowledge.unccd.int/sites/default/files/2019-04/Model%20Drought%20Plan.pdf>

- iv. To continually document and review the initiatives taken by stakeholders to respond to droughts and to framework for integrating public and private sector actions to reduce the impact of human suffering;
- v. To outline the duties and responsibilities of all stakeholders with respect to drought;
- vi. To identify the most drought prone areas and vulnerable sectors;
- vii. To identify additional mitigation and adaptation measures/actions that can be taken to address vulnerability and reduce drought impacts and risks;
- viii. To provide a mechanism to ensure timely, accurate assessment of drought impacts on the various sectors (for example, agriculture, health, industry, among others);
- ix. To sustain a comprehensive public education programme on drought condition, mitigation and adaptation and water conservation actions that are informed by timely, science-based information;
- x. To establish and pursue a strategy that will address more equitable access to water during shortage and to encourage demand management; and
- xi. Establish a set of procedures to periodically review and revise the NDMAP in response to the specific needs of the country.

#### Guiding Principles

The NDMAP is based on the following operational guidelines/principles that will govern the prevention, mitigation and management of drought and its impacts.

#### *Preparedness*

Mechanisms will be put in place to allow all stakeholders (government, professional response organisations, communities, and individuals) to be aware of drought risks, and to anticipate and respond effectively to the impact of imminent drought events or conditions.

#### *Scientific Assessments*

Drought management decisions, including policy measures, will be informed by sound scientific evidence.

#### *Timely Decision-making*

Drought conditions occur over time, making it very challenging to take immediate action. Decisions must therefore be made in a timely manner to avoid unnecessary stress.

#### *Effective Stakeholder Participation*

All stakeholders have a vital role in drought management and as such, (they) should involve in all phases of the process and continuously, based on their organisational mandates and capacities. Education and training are therefore essential for all stakeholders in order to reduce local drought risks.

### *Flexibility*

As new information becomes available through sound scientific processes, drought mitigation and adaptation priorities, objectives and measures will be reviewed and revised in response to different socio-economic, biological, and geo-physical conditions.

### *Effective Information Management and Communication*

The effects of drought can be substantially reduced if people are well informed and motivated toward a culture of disaster prevention and resilience. Thus, effective information management and exchange requires strengthening dialogue and networks among disaster researchers, practitioners, and stakeholders in order to foster consistent knowledge collection and meaningful message dissemination.

Additionally, the effects of drought will be substantially reduced if people are well informed and motivated toward a culture of disaster prevention and resilience; therefore, a broad-based public sensitisation programme will be sustained to ensure Guyanese know how to prepare for, and respond to drought when it comes. Importantly, information disseminated will be tailored to the needs of specific groups (farmers, small businesses, students, among others).

### *Effective Monitoring*

Periodic evaluation of new information through research, available technology, any new legislation etc. will be conducted prior to the review and updating of this Drought Mitigation and Adaptation Plan.

## The Process of Designing the National Level Plan of Action

The National Drought Mitigation and Adaptation Plan would provide a comprehensive framework to guide collective and integrated actions to mitigate and adapt to drought conditions in Guyana. To this end, a plurality of data collection methods was employed to ensure data triangulation and a participatory process.

### 1.4 Meeting with the UNCCD Focal Point Agency

Initially, a meeting was held between the Consultant and representatives of the National Focal Point to the UNCCD (Guyana Lands and Surveys Commission) to discuss and agree on the stakeholders and the process that would be adopted, given Guyana's peculiar national circumstances.

### 1.5 Phase 1: Comprehensive Literature Review

A comprehensive literature review of accessible documents (online and hard copies; See bibliography) was undertaken to provide context, impacts, issues, institutional response/s, and current and future initiatives, gaps, etc). Some of the questions that were asked to derive this goal:

- i) What does the policy/strategy/plan address?
- ii) Which institutions deal directly or indirectly with droughts or are impacted by droughts?

- iii) What is the implication for drought mitigation or adaptation?
- iv) What are the challenges?
- v) How has drought impacted Guyana at the national and sectoral levels?

#### 1.6 Phase II: Stakeholder Consultation

Semi-structured interviews were conducted with officials of twenty (20) organizations involved directly or indirectly with or affected by droughts or can influence the implementation of decisions. These officials were identified and contacted formally by letters to participate in the interviews (**See Appendix I**).

Some of the key stakeholders included the following organisations:

- Civil Defence Commission (CDC);
- Environmental Protection Agency (EPA);
- Guyana Fire Service;
- Guyana Lands and Surveys Commission;
- Guyana Red Cross Society;
- Guyana Sugar Corporation (GuySuCo);
- Guyana Water Incorporated (GWI);
- Hydrometeorological Department (Ministry of Agriculture, MOA);
- National Agricultural Research and Extension Institute (NAREI); and
- Office of Climate Change.

Information obtained from documents and stakeholders was analysed to determine current national situation regarding Guyana's historical drought experience (specifically, exposure, impact and vulnerability) institutional mandates and capacity, institutional practice, data collection, institutional collaborative arrangements, gaps, current and future initiatives, recommendations, among other issues.

#### 1.7 Phase III: Revision

The National Drought Mitigation and Adaptation Plan (Draft 0) was prepared and submitted to the National Focal Point Agency and the UNCCD Secretariat for initial comments and edits. Revisions were done and a second version of the Plan was submitted for dissemination to stakeholders in preparation for the validation process described below.

#### 1.8 Phase IV: Stakeholder Validation Workshop

A virtual Stakeholder Validation Workshop was conducted on June 15, 2020 and attended by twenty-nine (29) participants. The primary objective was to provide an opportunity for stakeholders to validate the draft NDMAP. The workshop programme consisted of major items: (i) Opening remarks by the Mr. Trevor Benn, Chief Executive Officer of the Guyana Lands and Surveys Commission and National Focal Point to the UNCCD; (ii) Presentation of the NDMAP (Draft 1); (iii) Tabling of the draft NDMAP for validation; (iv) Comments and feedback from stakeholders on the NDMAP; and (v) Outline of the next

steps. A final draft was then prepared in response to the comments and feedback from the stakeholders, who were also given a period of ten days to provide written submissions.

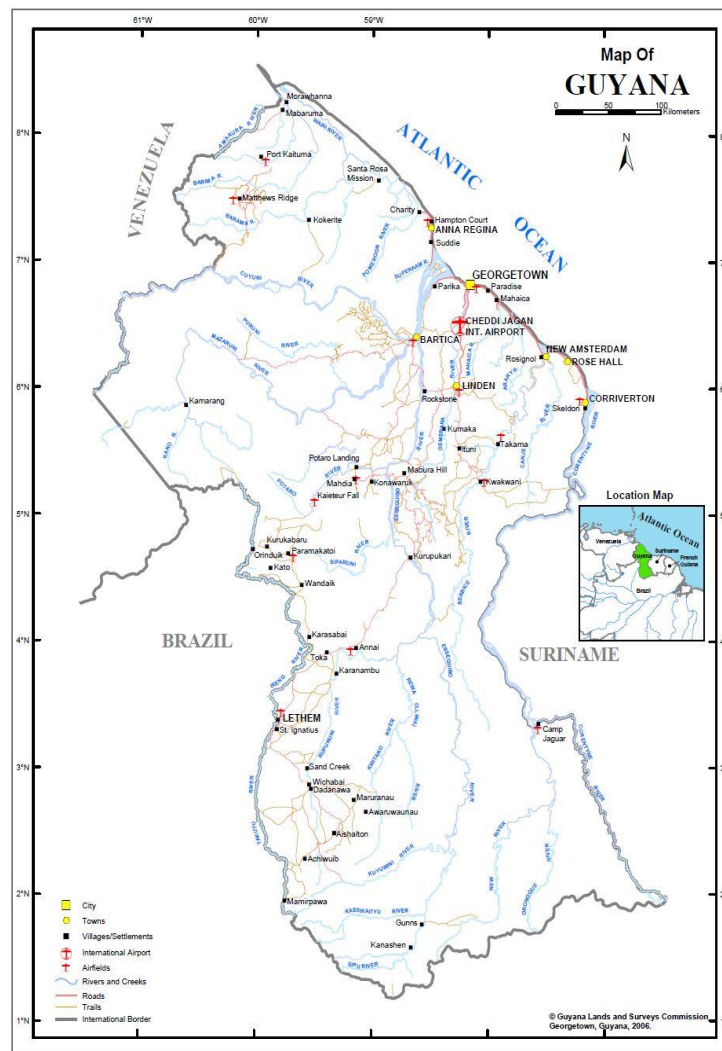
#### 1.9 Phase V: The Approval Process

The National Focal Point will submit the final National Drought Mitigation and Adaptation Plan to the Board of Directors for their approval, then to The Ministry of The Presidency for Cabinet's endorsement.

## CHAPTER 2 OVERVIEW OF GUYANA AND DROUGHT ISSUES

### 2.1 Geography and Population

The Co-operative Republic of Guyana, a low lying state with an area of 215,000 km<sup>2</sup> (land: 196,850 sq. km water: 18,120 sq. km), is located between 1° and 9° north latitude and 57° and 61° degrees west longitude, and lies along the north-eastern coast of South America bounded to the southeast by Suriname, South and Southwest by Brazil; North northwest by Venezuela; and north by the Atlantic Ocean (See Figure 1). The Coastline stretches from Playa in the west to the Corentyne River in the East (Daniel, 2001).



**Figure 2: Location of Guyana**

Source: <https://glsc.gov.gy/services/maps/>

Guyana is usually considered to consist of four (4) main natural regions, namely, Coastal Plain, Hilly Sand and Clay Region, Interior Savannas and Forested Highlands (Guyana National Land Use Plan, 2013), see Figure 2), although the FAO mapped five (5) separate Physiographic Regions as follows: 1. The Coastal Plain. 2. Interior Alluvial Plains and Low-lying Lands. 3. The 'White Sand' Plateau and Older Pediplains. 4. Crystalline Shield Uplands. 5. Highlands, Mountains and Plateau.

The Coastal Plain is a narrow belt (ranging between 8 and 65 km in width with a length of 440 km) stretching from the Corentyne River in the east to Waini Point in the west, and providing most of the agricultural production in the country. East of the Essequibo River, the Plain consists of recent and old sediments with recent deltaic and fluvio-marine clays and silts occurring on the coast with silty clays and sands inland. The recent Plain occurs at elevations of 2 m below to 3 m above mean high tide level, with sandy old beach ridges forming higher ground. The older coastal Plain lies at an altitude of about 3-9 m above sea level. This natural region is underlain by the Corentyne Group of rocks, the Sandy Rolling Land underlain by the Berbice Formation/White Sand Formation, the Pakaraima Mountain Region underlain by sandstones and shale from the Roraima formation, and the Pre-Cambrian Lowlands, which is mostly under tropical forest. Soil types found in Guyana are generally classified as follows: Coastal area consists of Clay, Sandy and Alluvial soils, while well drained soils consist of Regosols soils (aka White Sand). According to Daniel (2001), other soils found in Guyana are groundwater Laterite soils, Peat soils (poorly drained areas), Lithosols soil (mountain region), and Latosols (reddish brown), which occur in most parts.

The Hilly Sand and Clay Region, referred to as 'White Sand Plateau', which is essentially inland of the coastal zone, is gently undulating with altitudes varying from about 15 m above sea level close to the coast to 150 m in the south. The White Sands overlie brown sands and the unit also contains deltaic sands and clays, laterite gravels and bauxite, and is deeply dissected in the centre north of the area. In the north-east, and corresponding to the greatest extent of white sand, the Region has a distinctive vegetation of Wallaba and Dakama forest, Muri scrub and savannah grasslands. The white, sandy soil is permeable and low in nutrients, and forms the most vulnerable ecosystem in Guyana.

The Forested Highlands, which account for the bulk of the country, are often divided into the Western Highlands and Southern Uplands. The Western Highlands comprise the border of Venezuela and Brazil, and are rugged igneous and metamorphic mountains that are densely forested and virtually inaccessible. Topographically, it is a dissected upland with steep tabular hills and mountains cut by deep gorges. Rivers are fast flowing within deeply dissected terrain, creating deep gorges and waterfalls. The Southern Uplands is bordered by Brazil and Suriname and consists of four mountain ranges with elevations of 300-1,200 m. The Crystalline Shield Uplands occur in the north-west and south-east of Guyana and is part of the larger Guiana Peneplain. The unit is described as a monotonous continually rolling to hilly land, dominantly forested. The Highlands, Mountains and Plateaus unit corresponds primarily to the Pakaraima Mountains but also includes many isolated mountainous areas (inselbergs) within the Crystalline Uplands in the north-west, centre and south of Guyana as well as including the Kanuku and Acharai Mountains.

The Interior Savannahs account for approximately 8% of the country's area and are vegetated by grasses, scrub and low trees. The Rupununi Savannah is divided into the northern and southern savannas by the Kanuku Mountains. The FAO maps the northern Rupununi Savannahs as Interior Alluvial Plains and the southern Savannahs as part of the White Sand Plateau and Older Pediplains.

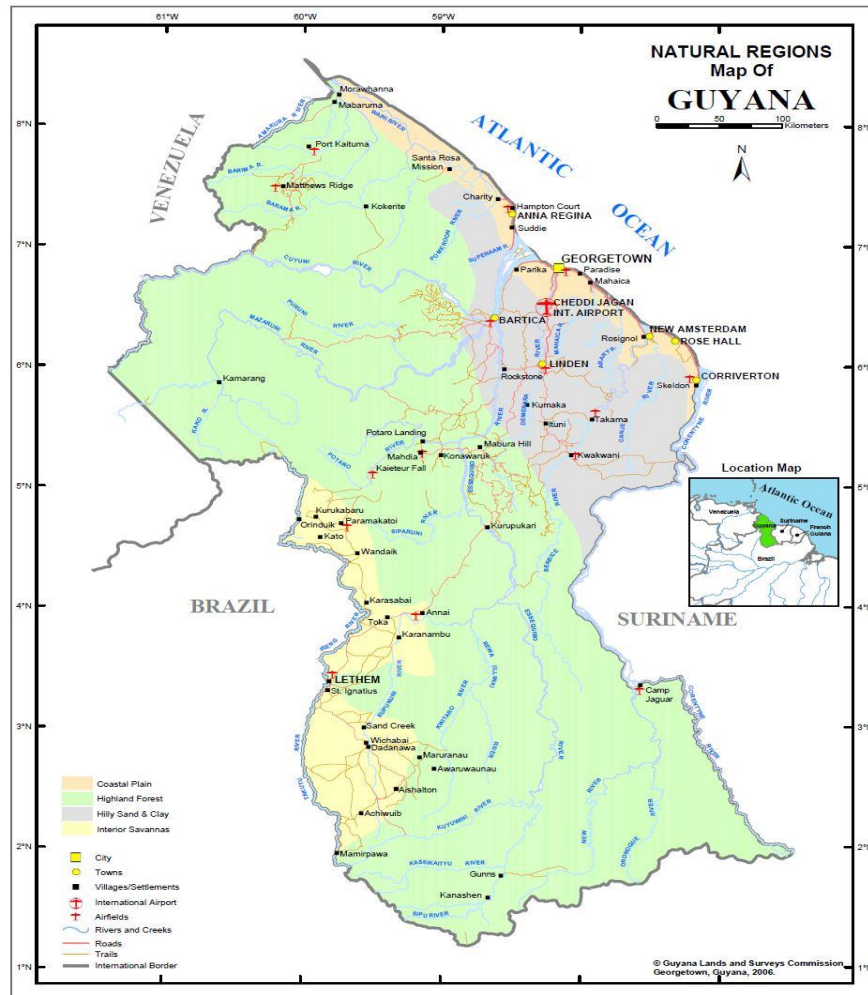
The Savannah is generally flat, though some areas exhibit tends to be more dissected characteristics, with an undulating topography, particularly to the north and east of the Kanuku range. The northern Savannahs are characterized by large areas of wetlands caused by the backflow of the Takutu and Ireng Rivers during the Amazonian wet season. The southern Savannahs are composed of Precambrian aged rocks. Additionally, the northern Savannah plain lies at an altitude of about 100-110 m and the Pakaraima Mountains rise abruptly from the plain to altitudes of 610 m and reach heights of 990 m at their highest. The Kanuku Mountains rise to 760-840 m. Contrastingly, the southern Savannahs are characterized by a relatively flat plain at a height of 100-120 m with granitic inselbergs rising abruptly from the plain to heights of 760 m<sup>5</sup>.

Guyana is richly endowed with mineral resources wherein most of the country's mineral wealth lies in the forest zone. Geologically, in addition to the mineral wealth, Guyana in recent years has discovered large petroleum deposits within the seabed of our ocean waters. This has opened up new expanding opportunities in the extractive and productive industries.

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<sup>5</sup> See <https://www.cbd.int/doc/world/gy/gy-nbsap-v3-en.pdf>

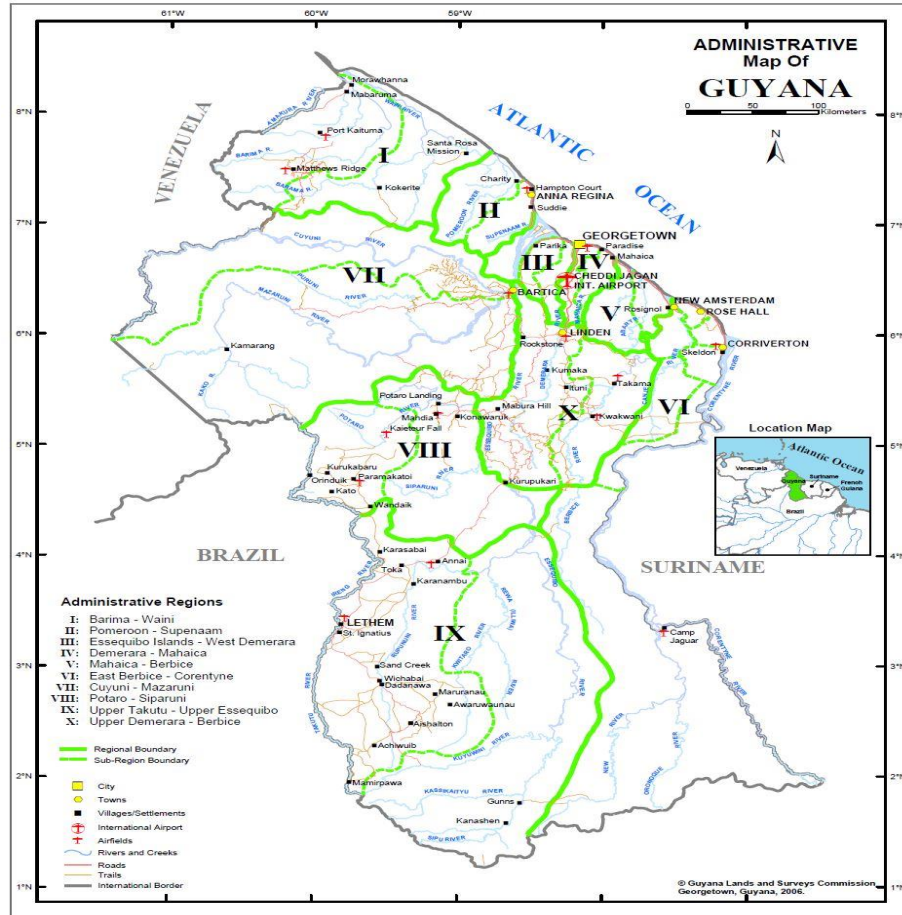




**Figure 3: Natural Regions of Guyana**  
Source: <https://glsc.gov.gy/services/maps/>

There are ten administrative regions<sup>6</sup> in Guyana (see Figure 3 and Table 2).

<sup>6</sup> In 1980, Guyana instituted a regional system of sub-national administration consisting of 10 Regions, mostly demarcated by following the courses of rivers (Bulkan, 2013).



**Figure 4: Guyana's Administrative Regions**

Source: <https://glsc.gov.gy/services/maps/>

**Table 2: Details on Guyana's Administrative Regions**

No	Region	Area km <sup>2</sup>	Population (2012 Census)	Population (2012 Census) per km <sup>2</sup>
1	Barima-Waini	20,339	26,941	1.32
2	Pomeroon-Supenaam	6,195	46,81	7.56
3	Essequibo Islands-West Demerara	3,755	107,416	28.61
4	Demerara-Mahaica	2,232	313,429	140.43
5	Mahaica-Berbice	4,19	49,723	11.87
6	East Berbice-Corentyne	36,234	109,431	3.02
7	Cuyuni-Mazaruni	47,213	20,28	0.43
8	Potaro-Siparuni	20,051	10,19	0.51
9	Upper Takutu-Upper Essequibo	57,75	24,212	0.42
10	Upper Demerara-Berbice	17,04	39,452	2.32
	<b>Guyana</b>	<b>214,999</b>	<b>747,884</b>	<b>3.48</b>

Source: Guyana Population Census (2012)

The population of Guyana in 2012 was 747,884 inhabitants<sup>7</sup>, slightly smaller than the 2002 population (751,223 people) according to the Bureau of Statistics Guyana (2014). The largest age group falls between ages 15 and 19. Children aged 0 to 15 represent around 36% of the country's population.

According to the Guyana Bureau of Statistics (2014), the Coastal Regions of Guyana (Regions 2, 3, 4, 5, 6 and 10) account for 88.1 % of the total population, while the Hinterland Regions (Regions 1, 7, 8 and 9) account for the remaining 10.9% that is relatively inaccessible, but provides the natural resources for most mining, logging and subsistence agricultural activities.

Guyana is considered a medium human development country. In addition, Guyana's HDI value of 0.670 in 2018 implies that the country is in the medium human development category, positioning it at 123 out of 189 countries and territories. This corresponds with improvements in the life expectancy at birth, mean years of schooling and expected years of schooling since 1980 (UNDP, 2019). The country also has a high literacy rate (UNESCO Institute of Statistics, 2014) and public education is available from nursery to tertiary levels. Despite the fact that the latest value shows an improvement of 0.87% when compared to the value in 2000, the country has been stagnated in the same ranking position since 2008. Further, the 2016 State of the Environment Report notes that the proportion of people living in extreme poverty in Guyana fell from 28.7 per cent to 18.6 per cent between 1993 and 2006, and that during the same period, the percentage of people living in moderate poverty fell from 43.2% to 36.1%. Moreover, according to the National Health Strategy for Guyana 2013-2020, poverty in the rural interior is significantly higher than in the rest of the country. While the incidence of poverty has declined since 1999, it remains particularly marked among Amerindian and rural interior populations, children and young people below 25 years old.

## 2.2 National Economy

Over the last 5 years, there has been consecutive economic growth of about 3.3% during 2014 to 2018. Guyana recorded a GDP of USD\$3.3 billion<sup>8</sup> in 2018 with a per capita GDP of USD\$4,395.00<sup>9</sup> (Bank of Guyana, 2018). Generally, the economy is traditionally based on agricultural production (mainly sugar and rice) and extractive industries (such as logging and gold and bauxite mining) which are the main foreign exchange earners. However, the burgeoning oil and gas sector will likely be the most significant source of investment, foreign exchange and economic growth.

In 2018, real GDP grew by 4.1%, led by construction and services sectors, up from 2.1% in 2017. Inflation remained low at 1.6% at end-2018. In terms of the sectoral composition of real GDP, the agriculture sector and the mining sector contributed to 16.1% and 13.6% respectively while the manufacturing sector and electricity and water activities contributed to 6.4% and 1.7% respectively for the same

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<sup>7</sup>The Worldometers estimates Guyana population at 786,279 in 2019. <https://www.worldometers.info/world-population/guyana-population/>

<sup>8</sup>US Exchange Rate: US\$1 = G\$213.17 (Bureau of Statistics, 2018)

<sup>9</sup>US Exchange Rate: US\$1 = G\$213.17 (Bureau of Statistics, 2018)

period. Moreover, expanding activities in the services sector accounted for 53.8% of real GDP (Bank of Guyana, 2018).

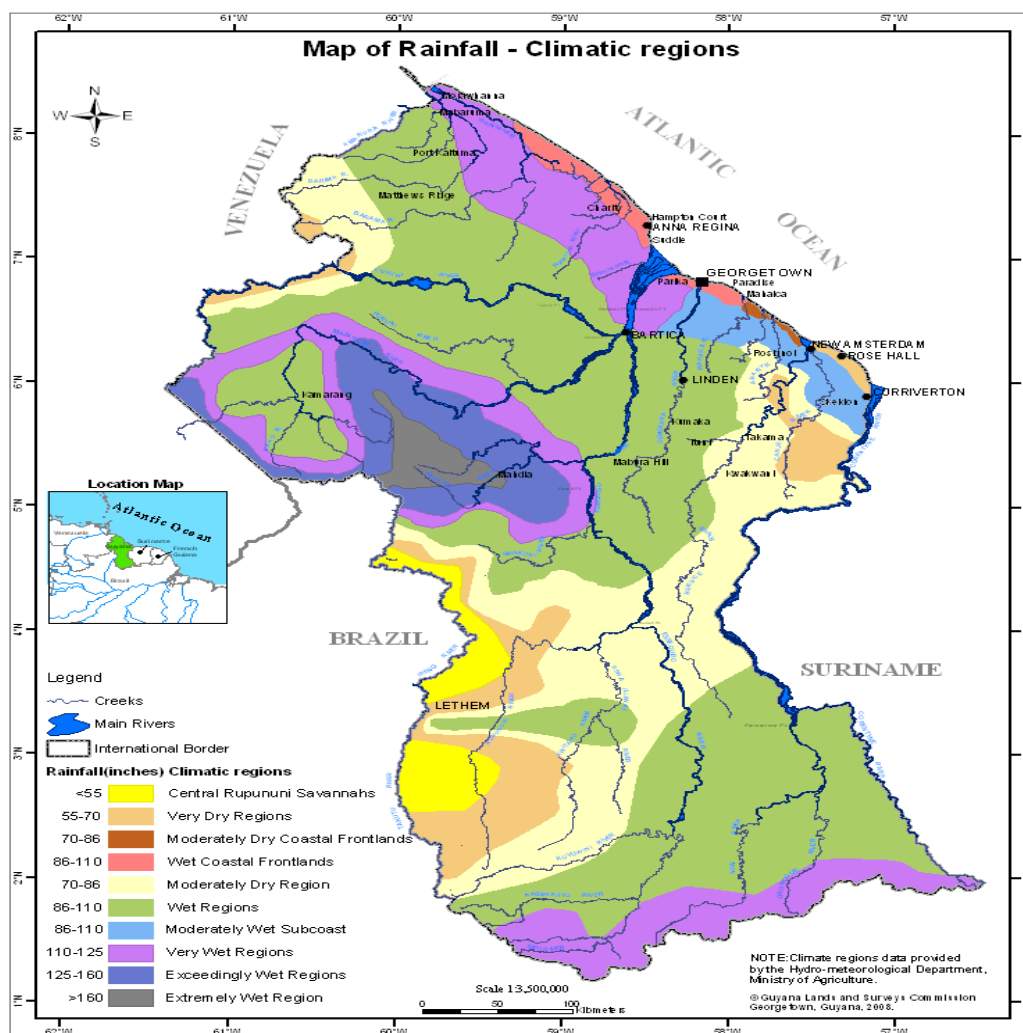
From an anticipated growth of 4.4% in 2019, Guyana's economy is projected to grow by 51.7 % in 2020. By 2024, the GDP is expected to expand to US\$15.5 billion with per capita GDP amounting to US\$19,400. Furthermore, the commencement of oil production in 2019 will substantially improve Guyana's medium- and long-term outlook. The oil sector is projected to grow rapidly, accounting for around 40% of GDP by 2024 and supporting additional fiscal spending annually of 6.5% of non-oil GDP on average over the medium term, which will help meet critical social and infrastructure needs (International Monetary Fund, 2019).

### 2.3 Climate

Guyana's weather and climate are influenced by the seasonal shifts of the Inter-Tropical Convergence Zone (ITCZ), a cloud, and rain-bearing belt of rising air where south-easterly and north-easterly trade winds converge, in turn affecting trade wind direction, and rainfall patterns. When the ITCZ is in the north, south-easterly winds prevail south of the equator and rainfall levels are high. On the other hand, most of the country receives less rainfall, with the exception of the coastal areas which benefit from north-easterly winds onshore, when the ITCZ is to the south (CRSAP, 2016) as shown in Figure 4.

Temperatures in Guyana vary geographically with high altitude regions experiencing cooler temperatures than the coastal and lowland zones. Temperatures in the upland regions and the interior (west) side of the country range between 20°C to 23°C; moreover, due to the stabilizing effect of the sea and the north-easterly trade winds, temperatures on the coast range between 22°C and 31°C (Bovolo et al., 2011). Observed climate data shows mean annual temperatures have increased by 0.3°C since the 1960s, corresponding to an average rate of temperature increase of approximately 0.07°C per decade, with the highest changes occurring in the August-September months (~ 0.10°C per decade). This rate of increase is below the global average warming of ~ 0.08°C per decade since the 1960s. The average number of cold days per year has decreased by 37 (10% decrease) and the frequency of cold nights has decreased at a similar rate (CRSAP, 2016).

With respect to precipitation, Northern Guyana has 2 distinct wet and dry seasons, while Southern Guyana has one wet season from April to August and the rest of the year is generally dry. The rainfall seasons in Northern Guyana are from Mid-April to the end of July and Mid November to the end of January., while the Dry Seasons are from August to October and February to March.



**Figure 5: Map of Rainfall - Climatic regions**  
Source: Drought Early Warning System Protocol, 2015

Over the last century, Guyana has experienced significant changes in its climate: while annual average rainfall range is usually between 1,600 mm to 3,000 mm, geographical influences, such as mountains and oceans, have resulted in three major climate types, namely, tropical savannahs (very dry regions), very wet tropical rainforest climate (very wet regions), and wet/dry tropical rainforests (wet/dry regions). Moreover, coastal locations have a mean temperature of 26.8 °C, while interior locations experience 27 °C. The Second National Communication (SNC) to the UNFCCC (2012) suggests that there has been an increase of 1.0°C in the mean annual temperature within the last century. While observed climate data reveal increases in mean annual rainfall, with an average rate of increase of 4.8mm per month, equal to 2.7% increase per decade since the 1960s, this trend is not statistically significant. A summary of the projected climate change impacts scenarios on Guyana are presented in Table 3 below.

**Table 3: Summary of climate change scenarios for Guyana**

Climate variable	2030s	2040s – 2070s	2070s – 2100
Average annual temperature <sup>10</sup>	↑ 0.4°C to 2.0°C	↑ 0.9°C to 3.3°C	↑ 1.4°C to 5.0°C
Average annual precipitation <sup>11</sup>	+0% to -4%	-4% to -8%	-4% to -5%
Proportion of total rainfall that falls in heavy events <sup>12</sup>		↑ 1-2%	↑ 2-3%
Sea level rise <sup>13</sup>	↑ 0.14 m to 0.26 m	↑ 0.21 m to 0.43 m	↑ 0.25 m to 0.51 m
Sea level rise + storm surge <sup>14</sup>	↑ 2.94 m to 5.94 m	.	↑ 2.93 m to 6.19 m

Source: McSweeney et al., 2008, Government of Guyana, 2012, cited in CRSAP, 2016.

Main variations in Guyana’s climate are attributed to the El Niño-Southern Oscillation (ENSO). This event<sup>15</sup> is one of the most prominent known sources of inter-annual variability in Guyana’s weather and climate. El Niño warm episodes tend to bring dry conditions throughout the year, and bring warmer temperatures between June and August, ENSO also affects Guyana’s coastal zone resulting in drought conditions.<sup>16</sup>

Notably, the ITCZ also influences Guyana. Trade winds blow mostly from the northeast in the northern hemisphere and from the southeast in the southern hemisphere and then they converge near the equator in a zone called the ‘Inter-tropical-convergence zone’, or ITCZ for short. The exact location of the ITCZ varies over time, but generally it oscillates north and south of the equator depending on the season. The ITCZ movement is generally greater over land than over the sea. Over the land, the ITCZ moves north during May to July to around a latitude of 7 degrees North, and south during November to January, placing it well over the Amazon basin. The variation in the location of the ITCZ affects the wet and dry seasons of the tropics.

<sup>10</sup>Results are minimum to maximum values across a range of scenarios and General Circulation Models (GCMs). Source: McSweeney et al., 2008.

<sup>11</sup> Results are median values across a range of scenarios and General Circulation Models (GCMs). Source: McSweeney et al., 2008.

<sup>12</sup>A ‘heavy’ event is defined as a daily rainfall total which exceeds the threshold that is exceeded on 5% of rainy days in current climate of that region and season. This table refers to median annual change in %. Source: McSweeney et al., 2008

<sup>13</sup>Source: Government of Guyana, 2012

<sup>14</sup>Source: Government of Guyana, 2012

<sup>15</sup> GOG.2012. Second National Communication on Climate Change Report to the UNFCCC.

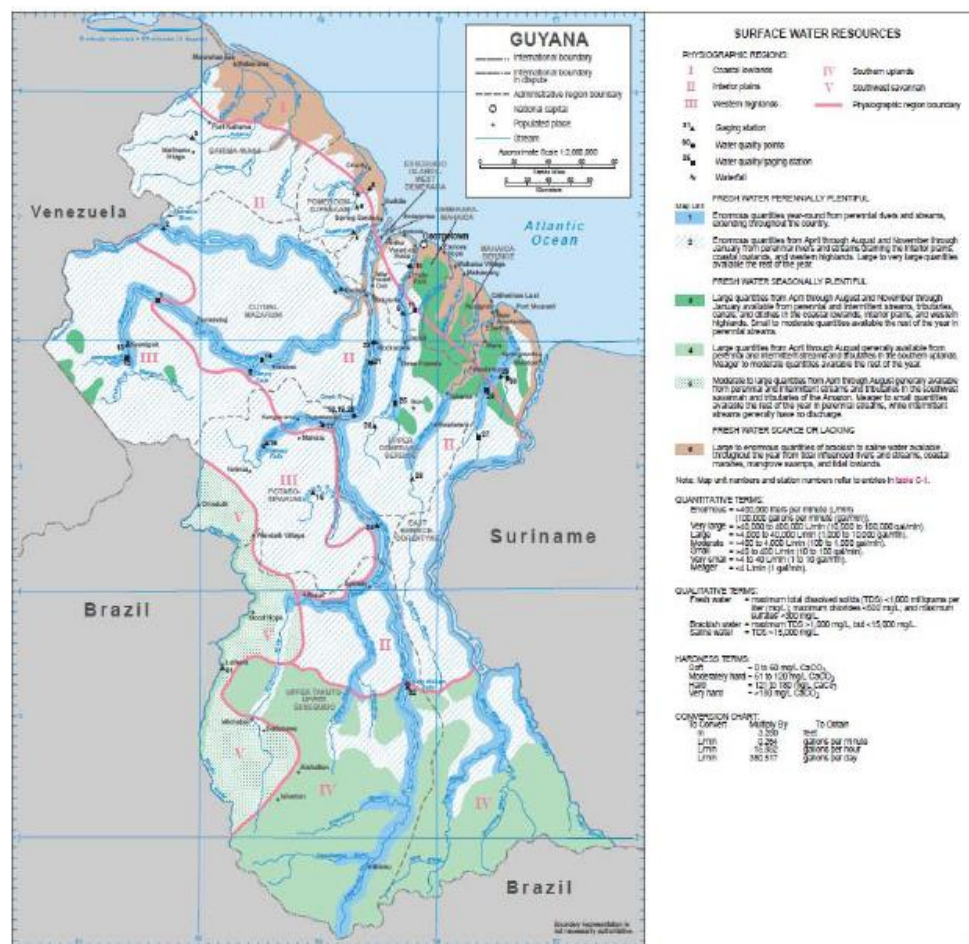
<sup>16</sup>[https://www.researchgate.net/publication/245409105\\_Influence\\_of\\_El\\_Niño\\_on\\_rainfall\\_in\\_Guyana\\_and\\_Uganda](https://www.researchgate.net/publication/245409105_Influence_of_El_Niño_on_rainfall_in_Guyana_and_Uganda).



The oscillation of the ITCZ over the coast of Guyana causes the two wet seasons experienced in June and in December. In the savannah region in north-eastern Brazil and southern Guyana however, the annual rainfall pattern exhibits a single wet season centred in June and a single dry season centred in December as a portion of the ITCZ over the land is mainly over Brazil at this time. Rainfall in the savannahs is significantly less than Lethem (Upper Takutu-Upper Essequibo Region), with about 1,300 millimetres of rainfall per year.

## 2.4 Water Resources<sup>17</sup>

In local Amerindian dialect, the word Guyana means “land of many waters”, with the rivers of Guyana generally flowing in a northerly direction towards the Atlantic Ocean (Daniel, 2001). This is clearly depicted by the Hydrological features in Figure 2 and Figure 6. The Essequibo, Demerara, Berbice, and Corentyne Rivers form the country’s largest rivers.



Source: USACE 1998

Figure 6: Hydrological Map

<sup>17</sup> Information for this sub-section has been provided by the Office of Climate change.

Guyana, one of eight countries sharing the Amazon Basin, is made up of several River Systems. The main ones can be summarized as follows:

- Essequibo River and its principal tributaries, the Mazaruni, Cuyuni, Potaro, Siparuni and Rupununi. Essequibo<sup>18</sup> is one of South America's principal rivers, with a mean flow of 2100 cubic meters per second;
- Corentyne, and its tributary, the New River;
- Berbice, and its tributary, the Canje;
- Waini, and its principal tributaries, the Barama, Imotai and Arawapai;
- Barima, and its principal tributaries the Aruke, Kaituma, Anabisi, Whanamaparu and Whanna;
- Demerara river; and
- Amacura river.

Additionally, the main rivers in Guyana, in most cases, run north to deposit their waters in the Atlantic, and in some cases run east as tributaries of the biggest river in the country, the Essequibo (). The most relevant catchments are the Essequibo, the Demerara, and the Berbice, which collectively hold most of the water in the country. Guyana presents a positive local annual water balance for practically 100% of its territory. The water balance averaging is 1140 millimetres per year, with maximum values up to 4100 mms per year in the wettest parts of the country (central area by the Kaieteur National Park; WW, 2017). The Essequibo River has the biggest catchment in the country; with an average discharge of 47.7 cubic kms per year in the Atlantic Ocean. (Zurita-Arthos, 2018; GFC, 2015).

Groundwater is an invaluable source of water throughout Guyana and accessible through shallow unconfined aquifers in the inland region and deep confined aquifers along the coast. With three major aquifer systems, in addition to the numerous rivers and creeks, carving this landmass, it is easy to understand why Guyana is called the 'land of many waters'. The three main aquifers together, cover an estimated recharge area of 53,515 km<sup>2</sup>, with rainfall ranging from 1,500 mm/year to 2,400 mm/year, for the inland aquifers, to exceeding 2,500 mm/year for the coastal aquifers. The availability of groundwater throughout Guyana is significantly high. This is evident particularly with the inland aquifers, which have approximately 490,000 and 1,500,000 m<sup>3</sup>/year/capita. The coastal aquifers are expected to have a much lower per capita rate given that the majority of Guyana's population lives along the coast and use this water source, unfortunately, this information was not available for the country (State of the Environment Report, 2016).

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<sup>18</sup> In fact, the Essequibo is the largest river flowing into the Amazon between the Orinoco and Amazon rivers. Much of the Guyana's hinterland area is drained directly or by major tributaries of the Essequibo and fresh surface water is generally in plentiful supply for most of the year;



With regard to water resources, the following issues are relevant for Guyana.

New models developed using the new IPCC Regional Concentration Pathways (RCPs) scenarios<sup>19</sup> at a global scale forecast the following:

- a) Substantial warming temperature extreme by the end of the 21<sup>st</sup> century.
- b) Precipitation and temperature changes which imply a possible change in floods.
- c) Droughts will intensify and increase in the 21<sup>st</sup> century.
- d) Mean sea level rise will contribute to upward trends in extreme coastal high-water levels in the future.
- e) Extreme events will have a greater impact on the sectors as water, agriculture, food security, forestry, health, and tourism.

The water sector in Guyana has been identified as a priority sector due to the fact that climate change can have a significant effect on the hydrological cycle and its key parameters, such as rainfall and temperature. All of them will affect one of the most important economic sectors such as the agriculture sector and the already vulnerable coastal zone, where most of the population lives. Without adequate management that considers the impact of climate change and other factors such as water quality or decreasing water supplies the attainment of sustainable development in any country<sup>20</sup> could be delayed.

In the coastal zone and hinterland regions of Guyana, relatively large volumes of freshwater are available close to the local population. FAO reported<sup>21</sup> in 2015 that Guyana's internal renewable water resources (IRWR) are estimated at 241 cubic kilometres per year (Table 1). Guyana is listed among the top five water surplus<sup>22</sup> countries in the world and has an annual per capita water availability of 314,963 cubic meters. Essentially, these figures indicate an enormous water surplus<sup>23</sup> but the quality and the availability could be affected if measures are not taken to combat drought and manage related impacts. Although Guyana has access to water resources, the efficiency of water use remains a challenge.

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<sup>19</sup>The RCPs are the latest iteration of the scenario process and are used in the IPCC report "Fifth Assessment Report" (AR5) in preference to SRES on (AR4).

<sup>20</sup>ECLAC, 2010. The Impact of Climate Change on the Water Sector in The Caribbean. LIMITED LC/CAR/L.26020 May 2010

<sup>21</sup>FAO, 2015. Regional Report: Southern America, Central America, and the Caribbean. Accessed October 17, 2017. [http://www.fao.org/nr/water/aquastat/countries\\_regions/GUY](http://www.fao.org/nr/water/aquastat/countries_regions/GUY)

<sup>22</sup>A National Strategy for Agriculture in Guyana, 2013-2020. Ministry of Agriculture. <http://agriculture.gov.gy/National%20Agriculture%20Strategy%202013-2020.pdf>

<sup>23</sup>National Land-Use Plan, 2013.

**Table 4: Renewable water resources in Guyana**

Precipitation (long-term average)	-	2387 mm/year   513 100 million m <sup>3</sup> /year
Internal renewable water resources (long term average)	-	241 000 million m <sup>3</sup> /year
Total renewable water resources	-	271 000 million m <sup>3</sup> /year
Dependency ration	-	11 %
Total renewable water resources per inhabitant	2013	338 750 million m <sup>3</sup> /year
Total dam capacity	2011	809.15 million m <sup>3</sup>

Source: FAO Aquastat, 2015

## **CHAPTER 3 RELATIONSHIP TO OTHER POLICIES, STRATEGIES AND PLANS (POLICIES, STRATEGIES AND PLANS AND THEIR RELEVANCE TO DROUGHT MITIGATION AND ADAPTATION)**

This Chapter provides an appraisal of national policies, strategies and plans in relation to drought mitigation and adaptation in Guyana. From the outset, it should be noted that the specific policies, strategies and plans that seek to address droughts in Guyana are yet to be implemented fully; therefore the design of the NDMAP is set to catalyse actions on the afore mentioned policy documents to ensure a unified and consolidated approach to drought management in Guyana.

### **3.1 Guyana Water and Sewage Act, 2002**

Guyana Water and Sewerage Act 2002 provides *ownership, management, control, protection and conservation of water resources, the provision of safe water, sewerage services and advisory services, the regulation therefore and for matters incidental thereto or connected therewith*. This Act also provides the legal framework for the establishment of a National Water Council with the responsibility of reviewing the national water policy, among other things.

The Water and Sewerage Act (2002, Cap. 30:01) is the main Act that governs the use and regulation of all of Guyana's water resources. It deals initially with the establishment of a National Water Council, a National Water Policy and the content of the National Water Policy. It also outlines the duties of the Minister and the Council.

This Act further outlines the roles and responsibilities of the Hydrometeorological Department, the main custodian of Guyana's water resources. Some of the specifications are as follows:

- Establishment of national monitoring systems;
- Establishment of mechanisms to coordinate monitoring of water resources;
- Establishment of hydrometeorological databases;
- Objectives of the hydrometeorological databases;
- Provision of information;
- Access to information; and
- Severe hydrological events.

Notably, Part VI addresses the issue of 'Drought Orders' and provides guidance on six issues: Power to make drought orders, variation or revocation of a drought order, provision of a drought order, duration, public supplier, offences against drought order. For example, if the subject Minister is satisfied with the advice provided by the Hydrometeorological Service (referred to also as Hydromet in this document) or *'otherwise that a serious deficiency of supplies of water in any area exists or is threatened, then, subject to the provisions of this Part, he may by order make such a provision with a view to controlling the*

*amount of water demanded and minimizing the economic and environmental impact of the deficiency.*  
(Part VI, 38 (1)).

Further, a drought order may have effect for a period of up to three months, and can be extended by the Minister by subsequent order for an additional period that does not exceed three months.

Although the Water and Sewerage Act 2000 provides a basis for Guyana to sustainably manage its water resources, the most challenging issue is implementing the Act; for example, the institutions that should play a critical role in shaping the proposed National Water Policy need to be strengthened, or at the least take some steps to advance their obligations as mandated by law.

### 3.2 Disaster Risk Management Bill, 2019

The Disaster Risk Management (DRM) Bill, 2019 does not address drought specifically, but rather, provides for the management of disaster (hazard related or man-made) and disaster risks through comprehensive DRM, the operation of a Natural Resource and Environment Cabinet Sub-Committee, renamed DRM Commission, a National DRM Fund to define the powers and duties thereof and for matters incidental thereto.

The Bill has multiple purposes:

- a) To provide the legal basis for the development of DRM policies, plans
- b) To improve the institutional and policy framework for the management of DR
- c) To set the legal framework for the facilitation of hazard impacts etc.

Importantly, the Bill empowers the National Disaster Risk Reduction Coordination Platform to collect, analyse and process information on disasters and disaster risk management, including risk factors underlying emergencies, recurring occurrences that result in loss, disaster prevention and mitigation measures, early warning signs, indigenous knowledge relating to DRM, emergency response resources, coordination of information systems at national, regional, and local community levels, among others. Additionally, the Bill outlines the duties of the Platform. The platform is crucial for national coordination of disaster responses etc.

The Bill also establishes a National Early Warning Alert System (EWS) that shall consist of a National Emergency Broadcast System, siren warnings, remote broadcast connections; and any early systems as may be prescribed. Other important aspects include the following the appointment of a disaster focal point, training of staff etc.; mainstreaming of Integrated DRM into the national development process; and enforcement of standards. This may be considered as the basis of policies, practices, processes and the creation of institutions and assignment of responsibilities in respect of DRM.

### 3.3 Guyana Drought Early Warning System Protocol, 2015

A Drought Early Warning System (DEWS) is a system for monitoring drought to provide timely information for decision makers to take measures to mitigate the impact. The DEWS should be able to detect emergence of rainfall deficits which is normally the best indicator of approaching drought period. Effective drought early warning requires the adoption of a protocol that includes the application of tools and indices in monitoring and forecasting and evaluation of water supply conditions and potential impacts in specific sectors.

This system also includes mechanisms and procedures for the collection and analysis of data and dissemination of the early warning messages on drought onset, progression, end and severity to a broad group of users in a timely manner so that it can be applied in decision making. DEWS is therefore an essential component of drought preparedness plans.

Guyana's DEWS Protocol (2015) empowers the authorities to forecast well in advance prolonged drought and take preventive measures to reduce or mitigate the impacts. To this end, there are three components: monitoring and early warning; risk assessment; and mitigation and response. The document categorically states that:

*The monitoring and early warning component of a drought plan is essential because it provides the foundation on which timely decisions can be made by decision makers at all levels (DMEWSP, 2015:7).*

The Protocol recommends that (a) the existing Guyana's Hydrometeorological Service works as the focal point for receiving drought forecasting information from abroad; and (b) for Guyana to have technical cooperation agreements with other national and international agencies, with more financial and human resources, working on droughts forecast in South America and the Caribbean.

The DEWS Protocol also identifies agencies that can assist Guyana in forecasting droughts. In particular, Caribbean Disaster Emergency Management Agency (CDEMA), Caribbean Institute for Meteorology and Hydrology (CIMH), Caribbean Meteorological Organization (CMO), National Institute for Space Research (INPE), and the Caribbean Drought and Precipitation Monitoring Network (CDPMN). Guyana is a member of the CDPMN.

#### *The Drought Committee*

According to the DEWS Protocol the Drought Committee should include, at least, representatives of the following agencies:

- Hydrometeorological Service (monitoring & warning);
- Government Information Agency (GINA) (communication);
- Civil Defence Commission (CDC) (communication, dissemination, preparedness & response);
- Guyana Lands & Surveys Commission (GLSC) (knowledge);
- National Drainage and Irrigation Authority (NDIA);

- Sea and River Defence Department (SRDD);
- Guyana Bureau of Statistics;
- Guyana Red Cross Society; and
- Environmental Protection Agency (EPA).

The DEWS Protocol also provides guidance on the Declaration of State of Potential Drought, Dissemination of the Information, Preparedness<sup>24</sup> to receive the Drought Protocol and Mitigation Plan, and Principles which are essential core values for the NDMAP.

Additionally, the main elements for a drought early warning system protocol are presented and includes recommendations actions for the local communities, and importantly for various sectors, such as agriculture, water and health. Further, a drought monitoring framework is suggested.

### 3.4 Disaster Risk Management Policy, 2013

The DRM Policy sets out the guiding principles and architecture for DRM in Guyana, and in so doing, presents the roles, responsibilities, authorities and key processes required to achieve a coordinated, coherent and consistent approach. Moreover, the Policy provides an overarching framework for decision-making and coordination across DRM sectors and stakeholders.

The strategic goals are as follows:

- Prevention and/or reduction of disaster impacts;
- Increased resilience of communities
- Integration and dovetailing of DRM actions, strategies and initiatives with national priorities
- Mainstreaming DRM into national development plans, among others.

An important element is the focus given to Gender in DRM. It is becoming increasingly clear that gender roles can affect women and men's risk and resilience to natural hazards, including drought and that men and women manage respond and experience disasters differently due to gender roles and gender inequalities<sup>25</sup>. Addressing these gender differences in DRM projects is vital to designing more effective projects that aim to build disaster resilience.

The DRM Policy, however, needs to be updated in light of the Sendai Framework for DRR (2015-2030) that was adopted on March 18, 2015, and particularly in the area of disaster preparedness for effective response, and to build back better in recovery, rehabilitation and reconstruction.

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<sup>24</sup> "Preparedness" is defined as "the knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions".

<sup>25</sup> See <https://olc.worldbank.org/content/introduction-gender-and-disaster-risk-management>.

### 3.5 National Integrated Disaster Mitigation Plan for Guyana, 2013

The National Integrated Disaster Risk Management Plan (NIDRMP, 2013-2023) presents a country level work plan for both state and non-state actors at the national, regional, and the neighbourhood/community levels to implement in an effort to address natural hazards to which Guyana is prone: floods and droughts. It is expected that this document will be reviewed periodically in order to align it with the results of activities implemented and the lessons learnt from both successes and failures.

It is evident that no analysis of droughts has been done; yet the Strategic Objectives have been developed for both droughts and floods. These include: (a) identification and quantification of risks and possible consequences; (b) reduction of risks through structural and non-structural measures; (c) risk transfer; (d) establishment of a continuous preparedness process in Guyana to enable adequate level of preparedness and response capacity; and (e) establishment of recovery mechanisms.

### 3.6 National Integrated Disaster Mitigation Implementation Strategy for Guyana, 2013

The Integrated Disaster Risk Management Strategy (2013) aims to provide guidance to the process of implementation of specific activities in accordance with the Guyana NIDRMP vision, goal, strategic objectives and outcomes over a ten-year period (2013-2023).

The development of the IDRM Plan and Implementation Strategy provides the blue-print/roadmap for Guyana to plan effectively and strategically to prepare for and mitigate as much as possible the disaster risks associated with floods and other climatic hazards to which the country is particularly vulnerable. To this end, the vision, goal and strategic objectives are very critical. However, given the fact that the disaster scenario in Guyana is largely driven by climatic factors, more effort should have made to link the strategy with those that already exist for climate change adaptation (for example, the National Climate Change Action Plan, 2001 and the Initial National Communication to the United Nations Framework Convention on Climate Change Secretariat, 2001). This would promote greater integration of IDRM in national planning processes and will also contribute to the optimisation of resources in terms of project outputs etc. Such an approach would also contextualise the increase in climate related risks and the need for all other outputs of the project (the DRM Bill etc.).

### 3.7 Early Warning Systems Framework, 2013

The Early Warning Systems Framework (2013) sets the framework for the generation and dissemination of timely and meaningful warning information of the possible extreme events or disasters, including droughts that pose a threat to people's lives. The principal objective is to empower individuals, communities and organizations at risk to prepare and act appropriately and in sufficient time to reduce the possibility of harm, or loss. To this end, there are three notable reasons for such a framework to be given very high priority in public policy:

- (i) Public safety, and the protection of human lives. Early Warning has proven repeatedly to save lives and lessen the extent of populations injured.

- (ii) Protection of the nation's resource base and productive assets: Infrastructure and private property or investments to ensure long-term development and economic growth. Investing in Early Warning and other measures of disaster reduction is neither simple nor inexpensive, but the benefits of doing so, and the costs of failing to, are considerable.
- (iii) Adaptation to climate change would be very difficult without timely and reliable information. People who depend on the climate for their livelihood also need information to be able to make informed decisions.

This Framework outlines the context and rationale for EWS, and presents different approaches to EWS, national capacities and future perspectives, and importantly, recommendations for a more robust EWS in Guyana. Reference is made to the Hyogo Framework, the HFA-based early warning guidance from CDEMA.

### 3.8 The Environmental Protection Act (EP Act), 1996

The EPAct 1996 is best described as the umbrella legislation that mandates the undertaking of a number of measures to safeguard the environment and its resources, including water resources. With respect to water resources, the EPAct makes mention of them in its reference to the completion of Environmental Impact Assessments "Every environmental impact assessment shall be carried out by an independent and suitably qualified person approved by the Agency..."

Additionally, mentioned in the miscellaneous regulations is "(1) The Minister may make regulations for the purpose of giving effect to the provisions of this Act, and in particular but without prejudice to the generality of the foregoing, such regulations may contain provisions in relation to: -

- Protecting the coastal and marine resources;
- Prescribing the maximum permissible concentration or level in water of any contaminant either generally or with respect to any part of the waters;
- Prescribing the maximum permissible concentration or level in water of any contaminant either generally or with respect to any part of the waters of Guyana specified in the regulations; and
- Prohibiting the dumping of waste into the marine environment.



### 3.9 National Climate Change Policy and Action Plan (2020-2030)

The National Climate Change Policy and Action Plan (NCCPAP, 2020-2030)<sup>26</sup> is Guyana's blueprint for national climate action coordination (as it takes precedence over any existing sectoral plan) that consists of 19 policy objectives and actions that address climate change adaptation, mitigation, resilience building and risk reduction over a ten-year period. Importantly, these objectives are clustered together in nine policy directives, namely:

- a) Establish climate infrastructure and physical development;
- b) Sectoral climate change mainstreaming for a healthy educated society;
- c) Implementation and use of green and clean technologies;
- d) Build a diversified, climate ready, low carbon Guyanese economy;
- e) Responsible management and utilisation of natural resources;
- f) Promote equitable participation in national decision-making processes;
- g) Drive climate change decision making that is based on leading edge scientific evidence;
- h) Develop and access finances and resources to achieve national climate change goals; and
- i) Encourage and promote cooperation on climate action between the public and private sectors.

It is noted that Policy Objective 1.2: Reduce disaster and hazard risks that jeopardise productivity and livelihoods highlight the need for both structural and non-structural measures in an effort to reduce floods and droughts in Guyana. Further, the NCCPAP advocates for the establishment of systems for contingency and emergency planning with an adequate level of preparedness and response capacity for those hazards, as well as the creation of emergency mechanisms and promotion of risk transfers.

### 3.10 National Adaptation Plan for the Cooperative Republic of Guyana, 2019

The National Adaptation Plan (Climate Change) for the Cooperative Republic of Guyana (2019) aims to ensure alignment with existing policies and programmes relating to economic, human health and safety and environmental aspects vulnerable to climate change. Thus, the goals are as follows:

- a) To reduce the vulnerability to the impacts of climate change by building adaptive capacity and resilience; and
- b) To facilitate the integration of climate change adaptation in a coherent manner into relevant new and existing policies, programmes and activities, in particular, development planning processes and strategies, within relevant sections and at different levels, as appropriately.

The Plan identifies drought related actions for the water sector as (a) Conduct analysis on past and current impacts of climate on water, including economic impacts.; (b) Improve knowledge of social vulnerability to climate-induced changes in water resources; (c ) Develop climate-resilient infrastructure to ensure availability of clean drinking water; (d) Explore the feasibility of well drilling to create a source

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<sup>26</sup> The National Climate Change Policy and Action Plan is awaiting Cabinet endorsement.

of water for vulnerable communities; (e) Explore other technologies for treatment of surface water in rural and hinterland regions; and (f) Conduct studies for the production of redundant supply to address climate change. To this end, responsibility is given to the Ministry of Agriculture, including the National Drainage and Irrigation Authority and Hydrometeorological service, the Civil Defence Commission (for Disaster response and management) and the Ministry of Communities for potable water supply, including Guyana Water Incorporated in major urban centres.

Importantly, cross cutting issue No. 2 aims to improve climate modelling and weather forecasting, research and data storage, and allow access to various users.

### 3.11 Guyana Second National Communication to the UNFCCC, 2012

Section 3 of Guyana's Second National Communication to the UNFCCC (2012) deals specifically with vulnerability and adaptation; as such, all adaptation actions cited are based on five pillars. Pillar No. 1 focuses on *Information, Research and Systematic Observation* in order to reduce uncertain regarding sectoral and territorial vulnerability, and to provide information for accurate decision-making and early warning systems. This intervention is critical to the process of drought risk reduction considering the interdependence of data-information-knowledge-policy. The implication here is for Guyana to develop the infrastructure (for example calibrated automatic and non-automatic stations) and the capacity to scientific research aimed at a greater understanding of drought issues in Guyana.

### 3.12 Land Degradation Neutrality Target Setting Programme (2017 – 2030)

In June 1997, Guyana ratified the United Nations Convention to Combat Desertification (UNCCD) and has since undertaken several laudable initiatives, including the development of Guyana's Aligned National Action Plan to Combat Land Degradation (2015)<sup>27</sup>, which aims to address key land degradation issues facing Guyana and provides consideration for the need for urgent efforts to integrate and strengthen existing national policies, strategies, action plans and the planning framework for conservation, promotion of sustainable land management, and combating the exacerbated effects of land degradation and drought.

The main objectives of Land Degradation Neutrality (LDN) are to:

- Maintain or improve ecosystem services;
- Maintain or improve productivity, in order to enhance food security;
- Increase resilience of the land and populations dependent on the land;
- Seek synergies with other environmental objectives; and
- Reinforce responsible governance of land tenure.

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<sup>27</sup> This was produced in fulfilment of Guyana's obligations to the UNCCD under which alignment of its National Action Plan (2006) to the UNCCD 10- Year Strategy (2008-2018) was done.

Moreover, in keeping with its obligations to the UNCCD, Guyana also developed a Land Degradation Neutrality Target Setting Programme (LDN TSP)<sup>28</sup> in September 2016. This initiative intends to halt the ongoing loss of healthy land through land degradation and balance losses with gains. It creates a target for land degradation management, promoting a dual-pronged approach of measures to avoid or reduce degradation of land, combined with measures to reverse past degradation. In Guyana, the coastline is prone to erosion, along with saltwater intrusion and flooding, and losses of arable land due to floods and droughts. The impacts of drought as detailed in the LDN TSP would be addressed in a proactive manner through the implementation of the NDMAP. Additionally, the threats that drought pose to achieving LDN Targets would be alleviated through the implementation of actions detailed in the NDMAP.

### 3.13 Aligned National Action Plan to Combat Land Degradation (2015 – 2025)

The Aligned National Action Plan 2015-2025 for Guyana for the United Nations Convention to Combat Desertification builds on the previous National Action Plan from 2006 and is updated to be aligned with the UNCCD Strategic Plan 2008-2018. Further updates to the NAP are necessary for realignment to the UNCCD Strategic Framework 2018-2030 to capture the current strategic direction of the UNCCD.

The Aligned National Action Plan to Combat Land Degradation (Aligned NAP, 2015) aims to ensure that the agricultural, pasture, mining, forest, coastal and other land uses and resources are managed as sustainable, productive systems that maintain ecosystem productivity and ecological functions while contributing directly to the environmental protection, economic growth and social livelihood of Guyanese. Additionally, the Aligned NAP outlines the approach and roadmap towards continuing to enhance the way of managing land and resources in Guyana and is governed by the following overarching principles:

- (i) Achievement of Sustainable Development;
- (ii) Land management governance and policy;
- (iii) Education, training and awareness;
- (iv) Knowledge information and research;
- (v) Evaluation and monitoring and;
- (vi) Partnership and financing.

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<sup>28</sup> LDN target setting was adopted at the UNCCD COP12. The LDN Agreement targets desertification, the restoration of degraded land and soil. Member countries are expected to set voluntary targets to achieve a land-degradation neutral world and that the amount of healthy and productive land may remain stable from 2030. Reports indicate that warming is taking place more at a 3°Celsius than 2°. In order to remain within 2°, there must be massive investment in sequestration. It is estimated that in 15 years the “emissions gap” could be reduced by half, thereby making soil carbon sequestration part of the Paris Agreement.

Key activities include the following: a national scientific study on land degradation; training in the use of relevant technology and information management systems; improvement of the institutional capacity and the collaboration between governmental agencies; mainstreaming desertification, land degradation and drought into relevant national policies, strategies and plans; finalization of the National Land Policy (ongoing process); strengthening the links between the UNCCD and the poverty and livelihoods elements of the sustainable development agenda, including Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs); and enhance the capacity to cascade regional (international) forecasts of Drought Early Warning Systems (DEWS), among other things.

Two specific activities have implications for drought mitigation and adaptation in Guyana: (i) Enhance the capacity to cascade regional (international) forecasts of DEWS to the national context and the analytical capacity of staff working on DEWS; and (ii) Conduct awareness of, and training in, specialised areas such as the process of dealing with drought in order to develop appropriate actions in case of unforeseen occurrence.

### 3.14 Green State Development Strategy: Vision 2040

Green State Development Strategy (GSDS), which can be referred to as Vision 2040, will guide Guyana's economic and socio-cultural development within the context of sustainability. This national document reflects the guiding vision and principles of the 'green agenda' as: "An inclusive and prosperous Guyana that provides a good quality of life for all its citizens based on sound education and social protection, low-carbon and resilient development, providing new economic opportunities, justice and political empowerment." The central objective is development that provides a better quality of life for all Guyanese derived from the country's natural wealth – its diversity of people and abundant natural resources (land, water, forests, mineral and aggregates, biodiversity).

The GSDS therefore promotes 3 key messages:

- Manage natural resource wealth;
- Support economic resilience; and
- Build human capital and institutional capacity.

Sub-section 2.3.4 B2 on Water Resources underscores the point that climate change presents a significant threat related to predictions of longer dry seasons which could impair the recharge cycles of rivers and aquifers. The GSDS recommends, among other things the amendment of the Water and Sewage Act (2002) to improve integrated water resource governance and management (Note coordination issue) and IWRM based on science-based research and analysis.

### 3.15 National Forest Policy Statement and Plan, 2018

Droughts impact forest and degradation of forest has dire consequences for natural climate variability, particularly temperature; therefore, in an effort to mitigate the effects of drought sustainable forest management must be implemented.

The new National Forest Policy Statement and Plan (2018) deals holistically with the management of forest resources, with a broader goal to maximize more than timber values from the resources. The overall goal of the Forest Policy and Plan is *the conservation, protection and utilization of the state's forest, by ensuring its social, economic and environmental attributes and benefits are sustained and enhanced for the benefit of current and future generations of Guyanese, whilst fulfilling Guyana's commitments under international agreements and Conventions."*

To this end, there are four specific objectives (SOs) that form the basis of all activities within the Plan, namely:

- i. Deriving development benefits from the forest (economics);
- ii. Conserving, protecting and sustaining the forest (conservation);
- iii. Governing the forest to ensure current and future benefits (governance); and
- iv. Building human and institutional capacity for management of activities in the forest (capacity).

### 3.16 Development of Guidelines for Incorporated IDRM in Agricultural Planning and Environmental Management, 2013

Development of Guidelines for Incorporated IDRM in Agricultural Planning and Environmental Management (2013) presents a structure for implementing IDRM in the agriculture sector; this involves five interconnected steps: (a) Get started; (b) Identify risks and consequences; (c) Assess and prioritise consequences of risks; (d) Prepare a draft Action Plan for IDRM; and (e) Implement IDRM for Agricultural Planning.

This document identifies droughts as risks of Regions 2 and 6 and provides guidance on how consequences can be assessed by frequency, damage and loss.

With respect to the IDRM for Agricultural Planning the document list 5 steps, namely:

- Develop draft implementation strategy
- Establish milestones
- Train staff and stakeholders
- Integrate Implementation strategy into government budgets
- Review action Plan for IDRM in Agricultural Planning

### 3.17 National Multi-Hazard Disaster Preparedness and Response Plan, 2013

The National Multi-Hazard Disaster Preparedness and Response Plan (NMHDP RP, 2013) provides details on the arrangements that are necessary to ensure Guyana can cope with the effects of disasters. Specifically, it aims to assign responsibilities and to provide coordination of emergency activities connected with major disasters, by adopting a comprehensive disaster management approach, ensuring the greatest protection of life, property and health. It is envisaged that the NMHDP RP will guide operational response to disasters in Guyana, provide information to the general public before, during

and after disasters, etc. A lot of focus is given to EWS in the way of protocols for communication and dissemination etc. and declaration of disaster (Levels 1 to 3). Importantly, the President has the power to declare a National or Regional Disaster, depending on the damage assessment.

Apart from regular localized cases of flooding, Guyana's other main disaster threats are from droughts and fires (NMHDPRP, 2013:17). However, the National Plan fails to include droughts as a hazard to be considered; as such, contrary to other hazards, there exists no Hazard Specific Sub Plan for Droughts in the NMHDPRP.

### 3.18 Challenges/ Gaps

#### 3.18.1 Institutional Framework

There is clearly a need for synthesis (of the existing legislation, strategies and plans) that is dictated by a clearly defined policy that promotes a more integrated approach among the various stakeholder institutions.

One of the key challenges of institutions with direct or indirect responsibility for drought risk reduction in the extraordinarily high human capital flight in Guyana (especially over the past five decades) that has resulted in severe shortages in managerial and technical capacity, for example, in water resource management institutions. This problem is exacerbated by limited equipment for monitoring and inadequate financial resources to execute various activities that promote watershed management. For example, the Hydrometeorological Division of the Ministry of Agriculture is the regulatory body for water resources management but has very limited capacity to carry out its mandate, including data collection on ground water resources. According to a 1998 Report on Water Resources Assessment of Guyana, *"Hydrologic data are lacking throughout the country, particularly since the late 1960's when data collection decreased dramatically."* In fact, with only few hydrologists, it is almost impossible to monitor water resources over a land area of 83,000 sq. miles<sup>29</sup>. Monitoring necessitates decentralization; however, this is difficult without the availability of adequate financial and human resources. Additionally, there is the challenge of a lack of adequate and timely scientific data upon which informed decision can be made. The paucity of data is affected by the human resource capacity.

#### 3.18.2 Public Perception and Attitudinal and Behavioural Challenges

Public perception of the water resources being 'plentiful' in Guyana has influenced public practices that sometimes defy the principles of conservation. The task is therefore to engage in a process that will effect lasting changes in public behaviour by promoting collective and social responsibility at every level of the Guyanese society.

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<sup>29</sup> This can be interpreted as a logistical problem.

### 3.18.3 Adequate Resources

The apparent deficit in the implementation of policy, strategies and plans in Guyana (as in the case of most developing countries) is linked to limited resources (financial, human, physical, and technical). To a large extent, Guyana has been dependent on external finance the implementation of recommendations of policy documents that would have been developed (most often than not) by means of consultancies that are funded by external stakeholders. In keeping with the need for innovative mobilization of financial resources to address resource challenges, Guyana has adopted a risk-based approach. This approach will look at investment at the national level to cover some aspects of the NDMAP. By extension, Guyana has commenced a process to align National Budgets for the year 2020 and onwards to the overarching GSDS: Vision 2040, in keeping with the developmental objective to sustainably manage our natural resources.

### 3.18.4 Need for Public ‘Buy In’ (Involvement in Implementation)

Most of the policy related documents are the outputs of donor funded projects; as such, there is need for widespread public awareness and education programmes to promote public ‘buy in’ and support for interventions at the national, regional, and community levels in Guyana.

### 3.18.5 Lack of Adequate Scientific Data

More scientific studies are needed on agricultural land use to promote a better understanding of the effects and benefits of drought tolerance practice in agriculture (crop, rice, and livestock production) in Guyana.

## CHAPTER 4 ASSESSMENT OF DROUGHT IMPACTS ON SPECIFIC SECTORS IN GUYANA

The UNCCD website indicates that globally over two billion people live in countries that experience high water stress. According to the Global Land Outlook (2017) with up to four billion people – over half the population of the planet – already facing severe water stress for at least one month of the year while half a billion suffer from permanent water stress. Moreover, it is estimated that 71% of the world's irrigated area and 47 % of major cities experience at least periodic water shortages. Additionally, the website notes that if this trend continues, the scarcity and associated water quality problems will lead to competition and conflicts among water users and that climate change will increase the odds of worsening drought and water scarcity in many parts of the world.

Drought impacts are essentially the effects of drought on lives, livelihoods, health, ecosystems, economies, societies, cultures, services and infrastructure due to droughts that affect vulnerability of an exposed society or system.<sup>30</sup>

### 4.1 Drought Impacts

Drought impacts are non-structural, in contrast to, the impacts of floods, hurricanes, and most other natural hazards. Such impacts are spread over a larger geographical area than are damages that result from other natural hazards. For these reasons, the quantification of impacts and the provision of disaster relief are far more difficult tasks for drought than they are for other natural hazards (DMEWSP, 2015:27). Serious drought-like events were documented in Guyana as far as September 1877 to April 1878 (Berlage, 1966); however, only information for droughts during the periods of 1997 to 1998; May 2009 to February 2010, and September 2012 to January 2013 is available and is provided below in Box 1, Box 2 and Box 3. Generally, historical records of impacts are either non-existent or currently inaccessible.

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<sup>30</sup> [http://catalogue.unccd.int/1247\\_UNCCD\\_EN\\_Web.pdf](http://catalogue.unccd.int/1247_UNCCD_EN_Web.pdf)



**Box 1: 1997-1998 El Niño Drought**

In July 1997, a severe drought in Guyana affected 607,200 persons and resulted in an economic loss of US\$29 Million. The drought produced unprecedented drought conditions throughout the country. Rainfall was 50% below 1996 rains, and rainfall during March 1997 was 85% lower than usual. This has resulted in severe water shortages that affected 80% of the population (759,000 inhabitants) and had dramatic effects on the economy. On March 26, 1998, the President of Guyana declared a state of national emergency.

During the drought of 1998, Guyana experienced water rationing, cessation of logging and river transport in some places and the loss of livestock. The rains between August 1997 and February 1998 were 75% below the normal precipitation. The lack of rain has not only created shortages of drinking water but it also reduced food supplies, as sea water moves upstream into agricultural areas and crops fail.

According to the Guyana Initial National Communication, April 2002, “the salinity of an estuary represents the outcome of: (1) the tendency for the ocean salt water to completely mix with the estuarine water, and (2) the tendency of fresh water flowing into the estuary to dilute the saline water and push it back towards the ocean. During droughts, the salt water penetrates upstream, as has been observed in the estuary of the Canje river while during the rainy season, low salinity levels prevails. A rise in sea level has an impact similar to decreasing the freshwater inflow.

Drinking water shortages occurred throughout the country, and particularly in the capital, Georgetown. Rivers, creeks and ponds shrunk and, in some instances, dried up completely or were contaminated by sea water, while wells and springs had run dry in hinterland areas. Unsafe drinking water and the risk of waterborne or water-related diseases constituted health threats: an increased number of malaria and dengue fever outbreaks were reported. Depleted river levels also hindered the use of waterways for transportation purposes.

**Box 2: The 2009 – 2010 drought**

The drought of 2009 - 2010 affected the whole Caribbean region. Stations recorded their lowest six-month totals (October 2009 to March 2010), leading to water rationing and major crop losses. In one of Guyana's regions the delivery of water through pumping and creation of canals reached a cost of US\$ 16,000 per day, pumping saline water to about 150 acres of rice lands. In February 2010, the Government of Guyana allocated US\$ 1.3 million for farmers relief in Region 2.

The water level at the East Demerara Water Conservancy (EDWC) was 51.65 GD by February 2010. This is significantly below the designated safe level for irrigation – 53.50GD (known as the dead storage level). An increased incidence of diarrhoea was attributable to the use of unsafe water. Most of Guyana's population live in a 30 kilometre band along the Atlantic coast (see Coastal Plain on the Natural Regions Map above in Figure 2). Much of the coastal plain is below mean sea level and is situated between freshwater reservoirs (Conservancies), and natural and man-made sea defence structures. A complex network of drainage and irrigation canals links with the East Demerara Water Conservancy (EDWC) to provide agricultural lands and urban areas with irrigation and drinking water. During times of heavy rainfall, this system functions as a regional drainage and flood control mechanism.

Source: - Document of the World Bank, FOR OFFICIAL USE ONLY, Report no: 39120-GY, Project Appraisal Document on a Proposed Grant from The Global Environment Facility Special Climate Change Fund in the amount of US\$3.8 Million to the Republic of Guyana for a Conservancy Adaptation Project, September 19,2007

**Box 3: The 2015 Drought**

Following extended periods of dry weather in 2015, Region Nine (Upper Takutu-Upper Essequibo) (see Map of Administrative Regions above in Figure 3) has been hit by a severe case of drought, causing all the water wells to dry up and frequent bush fires to break out – the latest of which destroyed several farms at Aranaputa.

The situation was caused by the low seasonal levels of rainfall in Region Nine and parts of Region One (Barima-Waini), due to frequent periods of severe drought experienced in the north-east region of neighbouring Brazil. This region has been experiencing droughts since 2011 resulting in millions migrating to São Paulo. However, even this major city is at risk of ending up without water since the February 2015 rains were not extensive.

In Region Nine, residents did not have access to potable water for domestic and agriculture use. The drought has also attracted a resurgence of pests that are attacking the few crops that survived the drought.

Farmers and ordinary householders in Guyana were expressing concern about looming water shortages resulting from the prolonged dry season that saw vastly reduced annual year-end rainfall levels. Guyana's authorities have spent \$1.2M to improve irrigation and to pump water into farmlands that are feeling the effects of largely absent year end rains. The latest forecast indicates the situation will continue up to March 2016. According to the climatic regions, some areas are more vulnerable than others due to the topography and vegetation cover (see Map of Climatic Regions (Figure 4) above). In response to this situation, the Guyana's Civil Defense Commission (CDC) was mandated to coordinate a response which is being led by the Ministries of Amerindian Affairs, Local Government, Housing and Water, and Public Works along with the Guyana Water Incorporated (GWI).

#### 4.2 Drought impact by sector

The impact of drought on various sectors can only be presented in summary due to the lack of specific details, which in turn can be linked to the absence of any nationally coordinated mechanism for drought impact assessment. Table 5 presents the details.

Notably, the Damage Assessment and Needs Analysis (DANA) Plan (2010) mandates specialist sectors (e.g. utilities, health, agriculture, welfare) and Non-Governmental Organizations (NGO) to conduct their individual damage assessment, and to provide reports on the extent of damage incurred to their facilities and livelihoods, and estimate time for repair and rehabilitation of facilities.

**Table 5: Summary of Drought Impacts in Guyana**

Sector	Summary of Drought Impacts in Guyana
<b>Agriculture</b>	<p>Reduction in the agricultural output due to pests, including acushi ants and caterpillars that attacked crops such as dasheens, cassavas, eddoes and cash crops, destruction of family farms by forest fires.</p> <p>Reduced supply of water to facilitate gravity irrigation of rice lands; Thousands of acres of rice would be under stress due to irrigation issues, resulting in higher cost of production related to energy (fuel cost) use to pump the water which is provided at field level.</p> <p>Other observed impacts include death and low production of animals, reduced forage, saltwater intrusion, increase in soil salinity due to high evaporation rates, low plant productivity associated with deficit of soil moisture.</p> <p>The Vulnerability and Capacity Assessment: Impacts of Climate Change on Guyana's Agriculture Sector (GuySuCo, 2009) summarises the El Niño Drought impacts on Guyana's agricultural sector as follows:</p> <ul style="list-style-type: none"> <li>▪ Drought and fires; state of emergency;</li> <li>▪ February 1998 rainfall was 18.2 mm from a normal 92 mm;</li> <li>▪ March 1998 rainfall was 85%- 90% below normal;</li> <li>▪ \$4 million was sought from the UN (to distribute water and food, and subsidize affected farmers);</li> <li>▪ Water rationing was in effect;</li> <li>▪ Weather forecasts allowed precautionary measures to be taken that reduced agricultural impacts;</li> <li>▪ Forest fires in the southern and western sections of the country; and</li> <li>▪ Death of livestock.</li> </ul>
<b>Education</b>	<p>Hinterland children are often required to travel miles to access water and often neglect school attendance in an effort aimed at water security. Additionally, because of drought conditions, especially in the interior regions, the water level is usually extremely low; as such, schools remain closed during such periods, thereby affecting children. Even when children are allowed to attend school the heat is so intense that they become very restless and lack concentration. In fact, stakeholders note that <i>the boys would often take off their shirts in an effort to feel cool</i> (UNICEF, 2018:47).</p>
<b>Economy</b>	<p>In 1998, officials of the Guyana Rice Development Board estimated that rice production for the spring season fell by 37%, a loss of USD 22 million, and GuySuCo anticipated a drop in the annual sugar production of 5%, a loss of USD 7 million. In addition, losses of livestock and crops such as cassava, coconut and coffee, while not quantified, were numerous.</p> <p>Further, gold exports were estimated to drop by 40%.<sup>31</sup></p> <p>In February 2010, the resultant losses were estimated at approximately GUY\$3 billion (US\$14.7 million).</p>

<sup>31</sup> <https://www.ifrc.org/docs/appeals/98/1498.pdf>

	At the regional and local levels, droughts have interrupted market access, trade and food supply, reduced income and employment, depleted saving and eroded livelihoods. There has also been an increase in farmers' debts.
<b>Forestry</b>	Droughts have increased soil degradation due to moisture loss and increased soil erosion, which in turn has affected standing forest and ecosystem services. Additionally, forest fires, which swept across Guyana for weeks, have destroyed state forests and farmland, as well as other assets. In 2018, forest fires that lasted for 2 weeks resulted in a loss of biodiversity in the Moruca River in Region 1.
<b>Mining</b>	<p>The impact of droughts on the mining sector have been observed as reduced production of gold and diamond; reduced health and safety of miners due to poor water quality (high levels of turbidity), loss of income (national contribution to GDP); and migration of miners from their sector to other sources of livelihoods.</p> <p>The El Nino Crisis in Guyana Report (1997-1998) states that gold and diamond mining operations in Regions 1,2,7,8,9 and 10 were being 'severely' affected. Normal operating capacity of small operations were reportedly reduced to about 20%. A shortfall of 50,000 ounces on normal production was estimated with a loss of about US\$14.5 million. Secondary effects were also evident in reduced demand for domestic flights to service miners' needs, migration of population from mining areas and slow-down of associated commercial activity.<sup>32</sup></p> <p>According to reports on more recent droughts <sup>33</sup>, gold export, Guyana's most lucrative export, dropped by 40%. Gold was mainly mined in rivers, and many of which had dried up. Rivers used by miners and loggers to transport equipment were also dry, forcing companies to close and miners to leave their families to seek employment in neighbouring countries.</p> <p>Other reported impacts include a notable decrease in the number of mining operations due to the lack of water resources, which also affected domestic supplies. Additionally, mining communities that suffered drought problems include Arakaka, Port Kaituma, Mahdia, Kurupung and the Marudi Mountain,</p>
<b>Public Health</b>	<p>Lack of access of potable water supply forced hinterland residents to use untreated water for domestic use, which at the time were flowing at low levels and with higher concentrations of sediments and other particles, resulting in an increase in the number of people suffering from vomiting and diarrhoea.</p> <p>Reduction in water supply has also impacted on sanitation, food preparation and ultimately public health. Other impacts include sporadic cases of gastroenteric disease, food and nutrition insecurity, and poor air quality.</p>
<b>Water</b>	Most irrigation water provided by the Boerasirie Water Conservancy (Region 2), and the East Demerara Water Conservancy (Region 4) conservancies have been affected by deficits and low water levels. Additionally, the Shelter Belt in Georgetown has been affected by significant levels of turbidity, colour alteration, less volume which in turn reduces households' access to potable water supply.

<sup>32</sup> See [http://parliament.gov.gy/documents/documents-laid/6159-el\\_nino\\_crisis\\_in\\_guyana\\_1997\\_-\\_1998.pdf](http://parliament.gov.gy/documents/documents-laid/6159-el_nino_crisis_in_guyana_1997_-_1998.pdf)

<sup>33</sup> See <https://drought.unl.edu/archive/Documents/NDMC/Workshops/13/Pres/Seulall.pdf>

	<p>Lack of rainfall also caused a decrease in water levels in the wells, lakes, ponds, rivers, creeks and other water sources, limited access to potable water for domestic and agriculture use, particularly in Guyana's hinterland.</p> <p>There have been drinking water shortages throughout the country, and particularly in the capital, Georgetown. Many coastal wells suffered saltwater intrusion, while wells and springs ran dry in hinterland areas.<sup>34</sup> There has also been increased turbidity of water due to pumping action and reported conflicts among water users.</p>
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Other observed impacts include dust pollution and forest fires that have destroyed the habitats and species of terrestrial biodiversity.

Additionally, a study conducted by Osmond and Adams (2007) assessed the impact of the El Niño Southern Oscillation event, on rainfall and sugarcane production in Guyana, with the aim to including climate information into the agricultural decision making. Thus, monthly rainfall data was collected from six estate locations from 1956-2006. Monthly Sea Surface Temperatures (SST) and Southern Oscillation Indices (SOI) were obtained from the National Oceanic Atmospheric Authority (NOAA). All data used in the study were evaluated on a crop bases (spring and autumn), in accordance with the local schedule. Analysis of the impact of ENSO influenced rainfall on critical crop growing period and subsequent yield revealed relatively stronger relationships and more consistency in the levels of significance realized. Entry points were then identified during both spring and autumn crops for possible inclusion of climate information into the Agricultural decision-making calendar of the corporation.

According to the UNCCD Policy Brief, at the national level, countries are committed to tracking and reporting indicators that are relevant to drought impacts and vulnerability for their Sustainable Development Goals (SDGs) to end poverty and vulnerability to disasters (SDG 1.5), alleviate water stress (SDG 6.4) and reach land degradation neutrality (SDG 15.3).<sup>35</sup>

<sup>34</sup> <https://drought.unl.edu/archive/Documents/NDMC/Workshops/13/Pres/Seulall.pdf>

<sup>35</sup> [http://catalogue.unccd.int/1247\\_UNCCD\\_EN\\_Web.pdf](http://catalogue.unccd.int/1247_UNCCD_EN_Web.pdf).

## CHAPTER 5 OVERVIEW OF INSTITUTIONAL LANDSCAPE FOR DROUGHT MANAGEMENT IN GUYANA

### 5.1 Organization Overview

In Guyana, there are currently more than 10 agencies with direct or indirect responsibility for drought management. Clearly, responsibilities are disproportionately allocated, given that each agency has the specific mandate; however, to promote and facilitate a more coordinated approach the Guyana Drought EWS Protocol has recommended the establishment of a Drought Committee that is chaired by the Civil Defence Commission. The primary function of this Committee is to receive the Hydrometeorological Service warnings about possible droughts and decide where the evidence justifies the dissemination of warnings to the country. According to the Protocol, the Committee members will comprise the following agencies:

- Civil Defence Commission (Chair and communication, dissemination, preparedness and response);
- Environmental Protection Agency;
- Government Information Agency (GINA) (communication);
- Guyana Bureau of Statistics;
- Guyana Lands and Surveys Commission (knowledge);
- Guyana Red Cross Society;
- Hydrometeorological Service (monitoring and warning);
- National Drainage and Irrigation Authority; and
- Sea and River Defence Department.

It should be noted that stakeholders representing the views of women and minority groups in institutional mechanisms for drought planning and implementation will be considered in the implementation plan to ensure membership is cross-cutting and inclusive. Some of these groups include the Water Users Association which comprises of farmers, the National Toshias Council which represents the interest of Indigenous Peoples, Women Across Differences which comprises a network of women and women organizations, and Youth Organizations.

### 5.2 Legal Mandate of Organisation and Drought Relatedness

The assignment of organizational responsibilities with respect to drought management in Guyana is presented in Table 6 below.

**Table 6: Organizational Responsibilities for Drought Management in Guyana**

Name of Organization	Year Established	Legal Mandate	Drought relatedness
<b>NATIONAL</b>			
Central Housing and Planning Authority	1948	To address the housing needs of the citizens of Guyana.	One of the objectives of the Agency, which is under the purview of the Ministry of Communities, is provision of services (access roads, internal road networks, <b>water distribution</b> networks, drainage, and electricity).
Civil Defence Commission (CDC)	1982	<p>National authority of DRM and DRR in the capacity of:</p> <p><b>Service Provider</b> – Promoting its role of providing services to local authorities/communities and for that purpose, to develop programmes designed to enhance those services.</p> <p><b>Planning and Implementation</b> – Ensuring the promotion and development at national level of disaster planning and management and, in co-operation with local authorities, facilitating the implementation of disaster management measures for the purpose of emergency relief and support.</p> <p><b>Loss reduction and Mitigation</b> – Promoting the adoption of disaster loss reduction and mitigation policies and practices at the national and local authority level.</p>	Drought is a hazard (in Annex of multi-hazard Plan)-Revised 2013 signed off by Cabinet; prepared in 2011.
Environmental Protection Agency (EPA)	1996	<p>To take the necessary measures to manage, conserve, protect and improve environment. This entails that the Agency takes actions to prevent and control pollution; assess the impact of economic development on the environment; and ensure the sustainable use of Guyana's natural resources. The EPA therefore has the mandate for</p> <ul style="list-style-type: none"> <li>- coordinating programmes to conserve and sustainably use of natural resources;</li> <li>- assessing the impact of development activities on the</li> </ul>	Ensure public health and environment are protected from drought impact (as much as practicably possible)

		<p>environment;</p> <ul style="list-style-type: none"> <li>- integrating appropriate environmental provisions into development planning; and</li> <li>- promoting public participation in environmental decision-making.</li> </ul>	
Guyana Forestry Commission (GFC)	1979	To ensure the sustainable management and utilization of the state forest resources.	<p>The GFC has implemented several measures to ensure Sustainable Forest Management (SFM) of state forest, including the following that ones that have implications for drought mitigation in Guyana:</p> <ul style="list-style-type: none"> <li>• Developed principles, policies, and guidelines for improved forest management and timber harvesting practices.</li> <li>• All large concessions must allocate 4.5% of the total area to biodiversity conservation during the life of the concession.</li> </ul> <p>Guyana has also embraced the REDD+ framework at a national scale and through this mechanism the country is consistently developing its efforts to reduce deforestation and forest degradation and, in particular, through the application of sustainable forests management. Any enhancement of carbon stocks (as in forests) will help the challenge of drought in Guyana.</p>
Guyana Geology and Mines Commission (GGMC)	1979	To provide effective stewardship of our mineral resources by ensuring increased opportunities for mineral resources development (exploration, documentation and extraction) and to promote and support increased investment in the mining and mining related sectors.	<p>During seasons of mining (water may be at low level or too high) thereby affecting exploration</p> <p>Above- surface minerals and cover (flora) may be affected. Additionally, mining is driver of deforestation and change in micro-climates due</p>



			to land preparation. Sustainable mining practices can reduce such negative impacts, for example, in mining areas, the focus is on land reclamation of previously mined out areas while ensuring current mining practices include mine rehabilitation.
Guyana Relief Council	1994	To bring relief to people affected by disasters and unforeseen circumstances.	The Council has a non-discriminatory policy and is geared to render assistance to all citizens of Guyana who have suffered through natural or manmade disasters including drought, and to deserving persons in difficult circumstances.
Guyana Rice Development Board (GRDB)	1995	<p>To develop the rice industry in Guyana and to promote the expansion of the export trade in the said industry;</p> <p>To establish facilities for the conduct of research, relating to rice and extending to rice farmers through an established system, the benefits derived from such research; and</p> <p>To engage in such promotional and developmental activities which the Board deems necessary for the purpose of developing the rice industry.</p>	Research and development of salt tolerant variety: less water and dealing with higher salinity level (from underground) as a critical adaptation measure to address drought.
Guyana Lands and Surveys Commission (GLSC)	1999; 2001	<p>To have charge of and act as guardian over all public lands, rivers and creeks in Guyana, to carry out various surveys of land and water resources of Guyana, to control and administer land surveys in Guyana, to establish and maintain a national survey control system, to evaluate offers for public land and to issue grants or leases.</p> <p>To establish and maintain liaison with the responsible agencies to promote and monitor, in relation to public lands, the provision and maintenance of drainage and irrigation systems, access roads and other infrastructure, through such measures as may be appropriate."</p>	<p>National Focal Point for the UNCCD and country obligations on desertification, land degradation and drought.</p> <p>The GLSC has guardian role for public lands, rivers and creeks and has a land management, land use planning, land policy formulation; additionally, drought is one area of the Convention, which is detailed in strategic objective 3 (to mitigate, adapt to, and manage the effects of drought in order to enhance resilience of vulnerable populations and ecosystems).</p>

Guyana Fire Service	1957	To protect life and property from destruction by fire and to attend to other disaster related emergencies and renders humanitarian services in collaboration with other agencies.	Offer humanitarian service, e.g. delivery of water to local communities.  Respond to fires that are drought related (e.g., forest fires in the Rupununi, Region 9).
Guyana Livestock Development Authority (GLDA)	2010	To promote greater efficiency in the livestock product industry and to provide enhanced services in livestock husbandry, livestock health and research so as to make provision for effective administration and regulation of trade, commerce and export of livestock or livestock products and for matters related and incidental."	Most animals are ruminants that are affected by water availability.  Rice crop is important as paddy husks are used as feed for pigs and chickens. Additionally, molasses from sugar cane is used as animal feed.  Lack of water results in reduction and cessation of forage materials; lack of water (10 gallons/day needed for non-ruminants).
Guyana Red Cross Society	1948; 1967	To improve the lives of vulnerable people (people affected by disasters, socio-economic crises, refugees, health emergencies and others) by mobilising the power of humanity (for example, through education, training).	Drought like other emergencies can affect people's quality of life, in terms of food supply shortage. Additionally, drought can cause other persons to become vulnerable due to loss of livelihood.
Guyana Sugar Corporation (GuySuCo)	1976	To cultivate sugar cane, produce sugar from sugar cane and sugar cane lands.	Water availability is critical element to agriculture (in this case sugar cane cultivation) and its industrial aspect such as the manufacturing of sugar, and means of transport of the produce.
Guyana Water Incorporated (GWI)	1929; 1972; 2002	To deliver safe, reliable and adequate water and to ensure safe sewerage systems for improved public health and sustainable economic development.	Provides access to potable water.  Operates in Regions 1, 7, 8 and 9 where both ground water and surface water are mostly affected by droughts.
Hydrometeorological Service	1965	To observe, archive and understand Guyana's weather and climate and provide meteorological, hydrological and oceanographic services in support of Guyana's national needs and international obligations evolving from four specific	Provision of hydrological, meteorological, oceanographic and related data, information, forecasts, warnings, investigation and advisory services on a national, as well as international

		activities: monitoring, research, services, and international collaboration.	bases; and  Publication of monthly of drought bulletins.
Mayor and City Council	1994	<p>The Municipal structure comprises ten municipalities in Guyana: Georgetown, Linden, New Amsterdam, Corriverton, Rose Hall, Anna Regina, and more recently, Bartica, Lethem, and Mabaruma and Mahdia.</p> <p>Each is charged with the responsibility of supplying a town with proper and sufficient water for sanitary and domestic purposes, for extinguishing fires and for private use. These provisions are found in Section 281(1) of the Municipal and District Councils Act.</p>	Section 282 of the Municipal and District Councils Act makes provisions for the connections of properties to the nearest water main. The connections are to provide continuous water supply, and are required to be maintained in a proper condition. This responsibility is performed by public supplier (the Guyana Water Inc.) as recognised by the provisions of the Water and Sewerage Act.
Ministry of Public Health (MoPH)	1934; 176; and 2005	To improve the physical, social and mental health status of all Guyanese by ensuring that health services are as accessible, acceptable, affordable, timely and appropriate as possible given available resources and enhance the effectiveness of health personnel through continuing education, training and management systems.	Drought results in food insecurity; water insecurity; poor sanitation, and livelihoods thereby affecting public health.
MMA-ADA (Region 5)	1978	To promote, facilitate and enhance sustainable agricultural development in the Region through the efficient management of the land resource.	Provides water control for the coastal lands up to a distance of some 30 miles inland, by impounding the flood waters in surface reservoirs (conservancies) located in the upper reaches of the rivers, and through the construction of appropriate civil engineering infrastructure, provide drainage and irrigation (D & I) services to the areas nearer the coast in Region 5. Related specifically to response. Operational systems have to be activated to reduce impact of El Niño: for example, there is one Abary-Berbice Conservancy that serves left Bank of Berbice River to right Bank of Abary River. The Conservancy is 312 sq. miles and serves all agricultural land cultivated by rice (mainly), sugar cane and grazed by cattle.

National Agricultural Research and Extension Institute (NAREI)	1984; 2011	To promote greater efficiency in the crops and agricultural product industry; providing enhanced services in Agricultural Research, Extension and Crop Protection, thereby allowing effective administration and regulation of trade, commerce and export of crops and agricultural products.	Water management and use: drip irrigation, shaded cultivation, hydroponics, use of bio-char to conserve moisture, especially in drought prone areas. Monitor: salinity in irrigation water and soil, emerging pest and disease incidence and preservation and introduction of germplasm and drought tolerant species (e.g. Cassava).
The National Drainage and Irrigation Authority (NDIA)	2006	To manage, improve, extend and provide drainage, irrigation and flood control infrastructure and services in declared areas of the country. Importantly, the Authority has developed an institutional structure in terms of water resources management strategy and water use planning for the primary purpose of locating, evaluating, conserving and distributing water resources of the country for agricultural purposes.	Supply of irrigation services; supervision of allocation of waters; especially during water deficit period.
Office of Climate Change (OCC)	2009	<p>To lead the development and implementation of national policies and actions for 'climate change mainstreaming' and the coordination of efforts to mitigate and adapt to climate change.</p> <p>The OCC is the National Focal Point for climate change and to the United Nations Framework Convention on Climate Change (UNFCCC) and therefore has a core responsibility to co-ordinate Guyana's international engagements with the UNFCCC and other climate change processes.</p>	<p>Interpretation of climatic trends; collaborate with Hydromet Service given interconnection of climate change and droughts.</p> <p>Policy development (mitigation, adaptation for communities esp. Hinterland and coast, plus Agriculture Sector; proactive approach adopted.</p>
<b>INTERNATIONAL COLLABORATORS</b>			
Caribbean Disaster Emergency Management Agency (CDEMA)	1991; 2005	To coordinate emergency response and relief efforts, and to promote Comprehensive Disaster Management to eighteen (18) Participating States (including Guyana) that require such assistance.	Issues drought warnings based on information from CIMH and coordinate response and relief efforts.

Caribbean Institute of Hydrology and Meteorology (CIMH) <sup>36</sup>	1999	To improve the meteorological and hydrological services and to assist in promoting the awareness of the benefits of these services for the economic well-being of the CMO countries. This is achieved through training, research and investigations, and the provision of specialised services and advice.	<p>Functions include:</p> <ul style="list-style-type: none"> <li>- Operate as a centre of research in meteorology and hydrology and associated sciences;</li> <li>- Provide advice to participating governments on meteorological and hydrological matters; and</li> <li>- Collect, analyse, and publish meteorological and hydrological data.</li> </ul> <p>Importantly, the CIMH produces the Caribbean Drought Bulletin tracks how dry spells or droughts, and to a lesser extent excessive rainfall, have developed in the past few months and up to a year.</p> <p>The Bulletin details drought situations at regional and national levels and for one-, three-, six- and 12-month time periods through short- and long-term drought outlooks and drought alert maps. It also provides information on drought impacts affecting the region's climate sensitive sectors.</p>
Inter-American Development Bank	Not applicable	<p>To reduce poverty and inequality, we help improve health and education, and advance infrastructure. Our aim is to achieve development in a sustainable, climate-friendly way.</p> <p>The Bank's current focus areas include three development challenges – social inclusion and equality, productivity and innovation, and economic integration – and three cross-cutting</p>	Provision of Technical Assistance in the form of training workshops (for example on flood risk assessment), critical infrastructure and policy development with respect to climate change adaptation and mitigation, and disaster risk reduction.

<sup>36</sup> CIMH is a training and research organisation formed by the amalgamation of the Caribbean Meteorological Institute (CMI) and Caribbean Operational Hydrological Institute (COHI). The Caribbean Meteorological Institute was established in 1967 by the member states of the Caribbean Meteorological Organisation (CMO) while the Caribbean Operational Hydrological Institute (COHI) was established in 1982. Even though the two Institutes were amalgamated since the mid 1980's, the organisation continued to be known as the Caribbean Meteorological Institute up until September 1999 when the name was officially changed to reflect the dual role of the Institute. Responsibility for the operation of the Institute rests with the sixteen Commonwealth Governments which comprise the CMO. Source: <http://www.cimh.edu.bb/?p=about>

		issues – gender equality and diversity, climate change and environmental sustainability; and institutional capacity and the rule of law.	
Pan American Health Organization/World Health Organization (PAHO/WHO)	Not applicable	To lead strategic collaborative efforts among Member States and other partners to promote equity in health, to combat disease, and to improve the quality of, and lengthen, the lives of the peoples of the Americas.	<p>Provides technical support to the MOPH, for example, The “Caribbean Action Plan on Health and Climate Change,” focuses on protecting the health of Caribbean populations from the effects of climate change, such as heatwaves, storms, hurricanes, droughts, floods, outbreaks of disease, and other issues, by strengthening health systems, promoting intersectoral collaboration between the health and environment sectors, and increasing financing.</p> <p>Direct technical assistance relates to droughts in on hinterland regions/areas only; for example, the development of a health sector self-assessment tool for disaster risk reduction.</p>
United Nations Development Programme (UNDP)	Not applicable	<p>To achieve the eradication of poverty, and the reduction of inequalities and exclusion, and to develop policies, leadership skills, partnering abilities, institutional capabilities and build resilience in order to sustain development results.</p> <p>The Strategic Plan (2018-2021) aims to:</p> <ul style="list-style-type: none"> <li>-Eradicate poverty in all its forms and dimensions</li> <li>-Accelerate structural transformations; and</li> <li>-Build resilience to shocks and droughts.</li> </ul>	<p>Implementing agency of a three-year (2018-2021) Japanese government funded project, “Strengthening Disaster Management Capacity of Women in the Cooperative Republic of Guyana and Commonwealth of Dominica:</p> <p>The project aims to reduce vulnerabilities and risks in the agriculture sector by targeting three broad drivers of these problems: gaps in gender analysis, hazard and risk data; limited integration of climate change and disaster risk planning and practices in the agriculture sector; and limited access to appropriate, sustainable finance for vulnerable small farmers and women’s groups.</p> <p>Focus is placed on pertinent areas such as strengthening community and women’s</p>

			<p>capacities in applying mitigation and adaptation measures to reduce livelihood vulnerability, strengthening accessibility and availability of preparedness measures (community-based and national Early Warning System), among other things.</p> <p>Financial support has been provided for the development of Guyana Multi-Hazard Disaster Preparedness and Response Plan.</p>
Food and Agricultural Organisation of the United Nations (UN FAO)	Not applicable	To achieve food security for all and make sure that people have regular access to enough high-quality food to lead active, healthy lives in over 130 countries worldwide.	<p>The FAO Country Office in Guyana has served as the Implementation Agency for the Sustainable Land Development and Management Project which aims to establish an enabling environment for promoting sustainable and climate-resilient land development, management and reclamation in support of Guyana's Low Carbon and Green State Development Strategies.<sup>37</sup></p> <p>Additionally, UN FAO makes available several provides tools for disaster management and specifically drought management.</p>
World Bank	Not applicable	To be a vital source of financial and technical assistance (financial products and service, and knowledge sharing) to developing countries as a unique partner to reduce poverty and support development.	Financed El Niño Emergency Assistance project to help restore Guyana's agricultural capacity in drought-stricken areas in 1998.

<sup>37</sup> For more information see <http://www.guyanareddfund.org/images/stories/ProjectDocuments/SLDM-Project-Documents/v3-for-Submission-to-GRIF-Steering-Committee-29-11-17.pdf>.

Other international collaborative initiatives include the following:

- Work between the GoG and the Government of Brazil for the drilling of eight (8) wells across 8 villages in deep South Rupununi. This agreement was signed in 2017 and the wells were completed in 2019.<sup>38</sup>
- Work of the United Nations to Combat Desertification (UNCCD) as it relates to drought. Could speak to the work of the Intergovernmental Working Group on Drought (IWG) that was established in September 2019 during UNCCD COP14. The IWG seeks to develop policy measures and actions to help the people most vulnerable to drought to take early action to avoid loss of life, and the heavy and growing losses of livelihoods and damage to property and ecosystems following droughts.<sup>39</sup>

At the national level, there is also the National Disaster Risk Reduction Coordination Platform (which has the participation of all key agencies and stakeholders), as well as the Guyana Geological and Mines Commission (GGMC) , since the agency plays an strong and active supporting role for overall natural resources management, parallel to agencies such as the EPA. Additionally, the GGMC should be strategically involved from a logistics standpoint for active data collection and transmission within the six mining districts in Guyana.

At the local level, there are ten Regional Democratic Councils (RDCs) that are tasked with the preparation of their respective disaster preparedness and response plans under the supervision of the CDC. Importantly, the preparedness and response plans of the RDCs also include the community-level (Neighbourhood Democratic Councils).

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<sup>38</sup> See link for more details <https://www.stabroeknews.com/2018/10/04/news/guyana/drought-relief-knowledge-transfer-expected-from-drilling-of-new-south-rupununi-wells/>

<sup>39</sup> See link for more details <https://www.unccd.int/issuesland-drought/intergovernmental-working-group-drought>



### 5.3 Summary of Key Issues related to drought management in Guyana

#### 5.3.1 Limited Decentralization of Drought Risk Management activities

Due to the limited staff of the CDC (currently 60% of needed capacity associated with transient nature of staff) and inadequate budget. Further, disaster management (DM) including drought activities are not fully decentralised.

Work has started in this regard through CDC on the development of Guyana's Country Work Programme (CWP) for Comprehensive Disaster Risk Management; for example training in the Sendai Framework Monitoring and the Comprehensive Disaster Management (CDM) tools and their usefulness in the development of Guyana's Country Work Programme (CWP).<sup>40</sup> However, there is a clear need for sustainable financing through line budget for DRM on an annual basis through the Ministry of Finance budgetary allocations, for the successful execution of programmes and projects.

#### 5.3.2 Inadequate Institutional Collaboration

Institutional collaboration is evident only in the sharing of early warning information by the Hydrometeorological Service and the participation of stakeholders in quarterly meeting of the National Disaster Risk Reduction Coordination Platform (NDRRCP), or in crisis management<sup>41</sup> whenever a drought impacts Guyana to the extent that livelihoods are lost and the local or national economy is severely affected. It should be noted that a Drought Committee has been recommended. Stakeholder consultation suggests that institutional collaboration could be strengthened through continual research on issues or risks and vulnerability.

#### 5.3.3 Reactive than Proactive and Drought Risk Management Approach

There is an urgent need for a transformational change in approach to DRM: from one that reacts to emergencies to one that proactively manages risks<sup>42</sup>; and hence a more strategic risk-based approach to drought management, focusing particularly on climate change, fire safety and water management.

#### 5.3.4 Lack of Impact Assessments based on Agreed Methodology

Efforts have been made by very few agencies to assess the impact of drought; thereby resulting in the absence of an archive of impact data at the national, regional level, or sectoral level.

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<sup>40</sup> See <https://dpi.gov.gy/multi-sectorial-agencies-representatives-benefit-from-harmonised-disaster-risk-management-monitoring-workshop/>.

<sup>41</sup> A system is in place for emergencies and disasters to be carefully monitored in the country, especially during the holiday period, but most importantly, it seeks to regularise the emergency framework that is in place countrywide.

<sup>42</sup> This involves the process of data and information gathering; risk analysis and evaluation; appraisal of options; and making, implementing, and reviewing decisions to reduce, control, accept, or redistribute drought risks.

## CHAPTER 6 DROUGHT MONITORING, FORECASTING AND IMPACT ASSESSMENT

Drought monitoring and forecasting by means of EWS often aim to track, assess and deliver useful information concerning climatic, hydrological and water supply conditions and trends.<sup>43</sup> This section highlights issues related to drought monitoring, forecasting and impact assessment. The monitoring component of drought management provides data on drought severity, whereas the forecasts informs about the probability of occurrence-both of which are critical components of drought management.

### 6.1 Drought Indices

The UNCCD website notes that the SPI as recommended by the WMO in 2009, is the principal meteorological drought index that countries should use to monitor and follow drought conditions, as it is an attempt to establish a level of drought early warning at the national level. The SPI has an intensity scale in which both positive and negative values are calculated, which correlate directly to wet and dry events. For drought, there is great interest in the ‘tails’ of the precipitation distribution, and especially in the extreme dry events, which are the events considered to be rare based upon the climate of the region being investigated. Drought events are therefore indicated when the results of SPI, for whichever timescale is being investigated, become continuously negative and reach a value of -1. The drought event is considered to be ongoing until SPI reaches a value of 0<sup>44</sup>.

Guyana uses the Standardised Precipitation Index (SPI), adopted by the World Meteorological Organisation (WMO) as the global standard to measure droughts. SPI was developed “primarily for defining and monitoring drought.” It is used to “determine the rarity of a drought at a given timescale of interest for any rainfall station with historic data” (National Drought Management Centre, 2013, p. 1). (See Figure 5 that depict 6 and 12 months SPI maps.

Currently, the Hydrometeorological Service maintains a rainfall network of 180 current and/or historical rainfall gauges plus 5 weather stations placed strategically across Guyana that facilitates the collection and ‘fitting’ of historic rainfall data to a gamma distribution to compute the country’s drought index (essentially the cumulative probability of a given rainfall event occurring).

It is worth noting that, in 2009/2010, the CIMH adjusted the SPI classification to ensure detection of drier conditions see severity classification in Table 7 and revised severity classification in Table 8 below.

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<sup>43</sup> See <https://knowledge.unccd.int/drought-toolbox/page/monitoring-and-early-warning>

<sup>44</sup> *Ibid.*

**Table 7: SPI Classification**

SPI	CATEGORY	PROBABILITY (%)
2.0 +	Extremely wet	2.3
1.5 to 1.99	Very wet	4.4
1.0 to 1.49	Moderately wet	9.2
-0.99 to 0.99	Near normal	68.2
-1.0 to -1.49	Moderately dry	9.2
-1.5 to -1.99	Severely dry	4.4
-2.0 and less	Extremely dry	2.3

Source: McKee et al. (1993) as reflected on the CIMH page <https://rcc.cimh.edu.bb/spi-monitor/>

**Table 8: Revised SPI Classification (used from 2011)**

SPI Value	Category	SPI Value	Category
-0.50 to -0.01	Normal	0.50 to 0.01	Normal
-0.80 to -0.51	Slightly dry	0.80 to 0.51	Slightly wet
-1.30 to -0.81	Moderately dry	1.30 to 0.81	Moderately wet
-1.60 to -1.31	Severely dry	1.60 to 1.31	Very wet
-2.00 to -1.61	Extremely dry	2.00 to 1.61	Extremely wet
less than or equal to -2.01	Exceptionally dry	greater than or equal to +2.01	Exceptionally wet

Source: <https://rcc.cimh.edu.bb/spi-monitor/>

## 6.2 Current Monitoring, Forecasting and Data Collection by Different National and Regional Stakeholder Organisations

Drought can be monitored well as a result of the slow onset of events that enable the observation of changes in precipitation, temperature, soil moisture, surface and ground water reserves, as well as social and economic behaviour, as indicated on the UNCCD website<sup>45</sup>. Further, the early detection of changes in these climatic parameters can promote effective and efficient drought preparedness and mitigation actions.

In addition to the use of the SPI<sup>46</sup> to monitor drought in Guyana mentioned in 6.1, the Hydrometeorological Service utilizes the Climate Predictability Tool (CPT)<sup>47</sup> to develop seasonal rainfall and temperature forecasts. It is also used to forecast droughts on a short-term (6 months) and long-term (12 months) timescale as depicted in Drought Monitoring Bulletins<sup>48</sup> and Season Climate Outlook (example can be cited online at <http://hydromet.gov.gy/wp-content/uploads/2017/09/Guyanas-Seasonal-Climate-Outlook-September-October-November.pdf>). The current status of the application of these tools may be best described as 'work in progress' as shown below in Figure 7 and Figure 8.

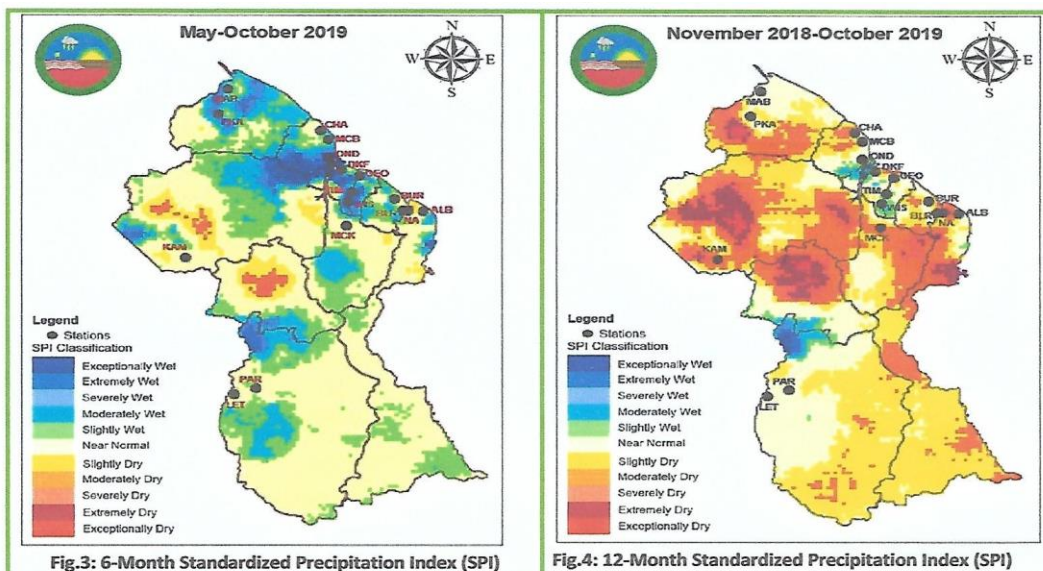
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<sup>45</sup> <https://knowledge.unccd.int/drought-toolbox/page/read-more-monitoring-and-early-warning>

<sup>46</sup> See <https://drought.unl.edu/droughtmonitoring/SPI/SPIProgram.aspx>

<sup>47</sup> The Climate Predictability Tool (CPT) is a software package for constructing a seasonal climate forecast model, performing model validation, and producing forecasts given updated data. Its design has been tailored for producing seasonal climate forecasts using model output statistic (MOS) corrections to climate predictions from general circulation model (GCM), or for producing forecasts using fields of sea-surface temperatures or similar predictors. Source: <https://iri.columbia.edu/our-expertise/climate/tools/cpt/>. This is work in progress for Guyana.

<sup>48</sup> <https://drive.google.com/file/d/1dUxo3ILYCEdnw9213H80KKgJn5OeSEtW/view>



#### STANDARDIZED PRECIPITATION INDEX (SPI) CLASSIFICATION

SPI Value	Category	SPI Value	Category
-0.50 to -0.01	Near Normal	0.50 to 0.01	Near Normal
-0.80 to -0.51	Slightly dry	0.80 to 0.51	Slightly wet
-1.30 to -0.81	Moderately dry	1.30 to 0.81	Moderately wet
-1.60 to -1.31	Severely dry	1.60 to 1.31	Very wet
-2.00 to -1.61	Extremely dry	2.00 to 1.61	Extremely wet
less than or equal to -2.01	Exceptionally dry	greater than or equal to +2.01	Exceptionally wet

Figure 7: Season Climate Outlook



## HYDROMETEOROLOGICAL SERVICE OF GUYANA

### DROUGHT MONITORING BULLETIN

*To observe, archive and understand Guyana's weather and climate and provide meteorological, hydrological and oceanographic services in support of Guyana's national needs and international obligations.*

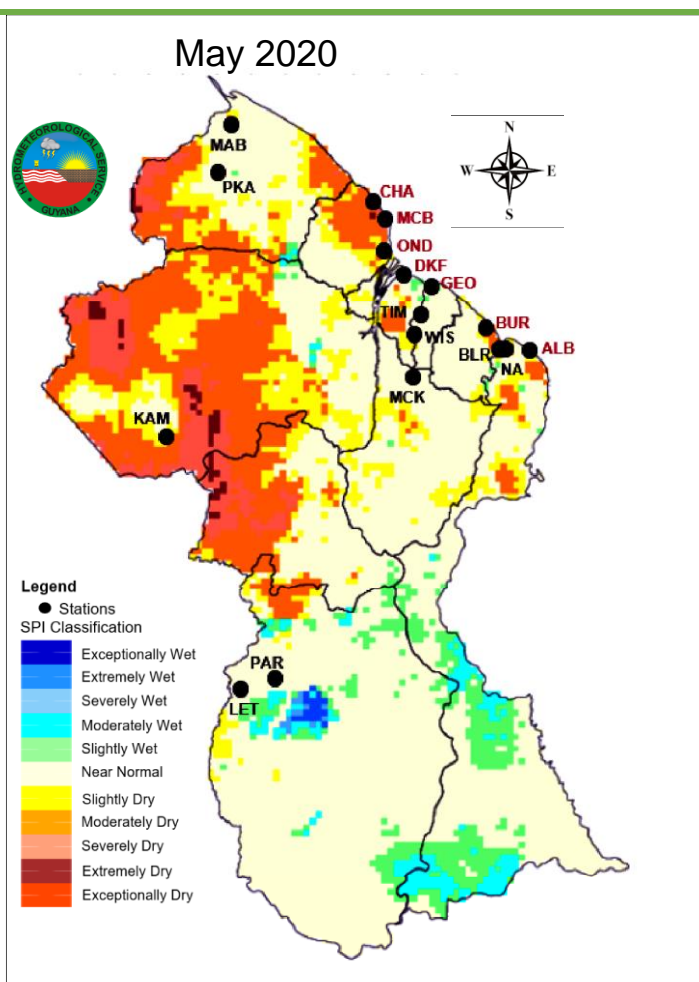


Issue # 32

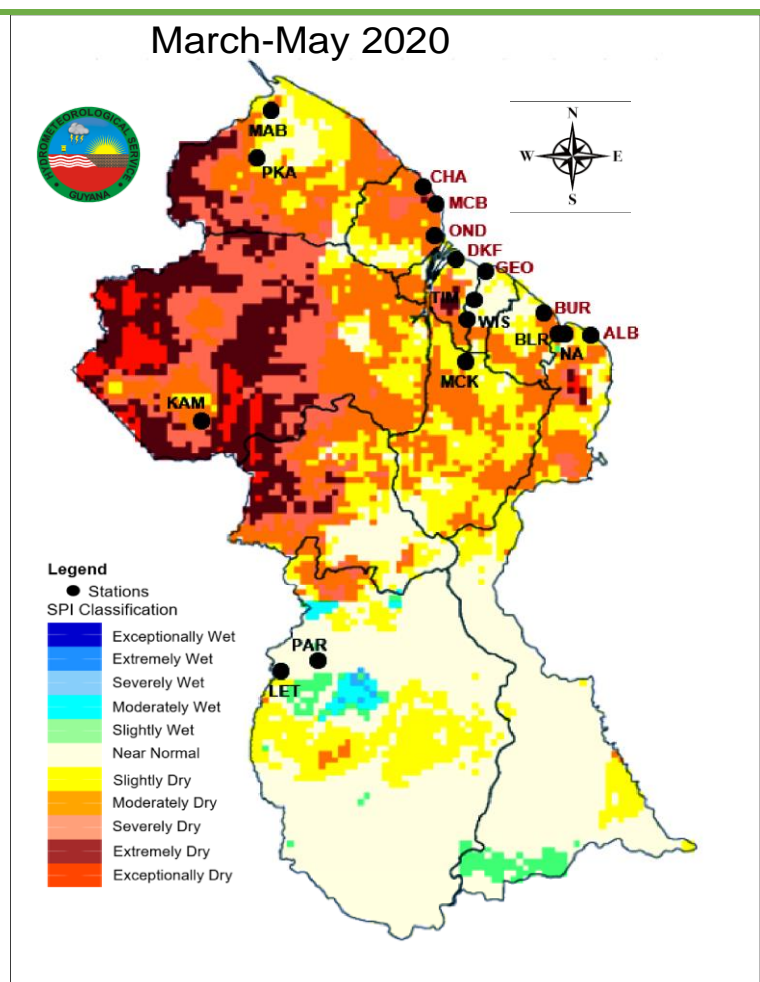
June 2020

**Highlights:** The Drought Monitoring Bulletin was prepared using the WMO recommended Standardized Precipitation Index (SPI). The maps represent the 1-month (May 2020), 3-month (March – May 2020), 6-month (December 2019 – May 2020) and 12-month (June 2019 – May 2020) SPIs respectively, showing various degrees of wetness and/or dryness across the country.

Several areas across Guyana have shown rainfall deficiencies over the 4-timescales. However, there is no major drought concern at the moment because the May/July rainy season is expected to bring relief to the areas that have experienced drier than normal rainfall conditions in the previous months.

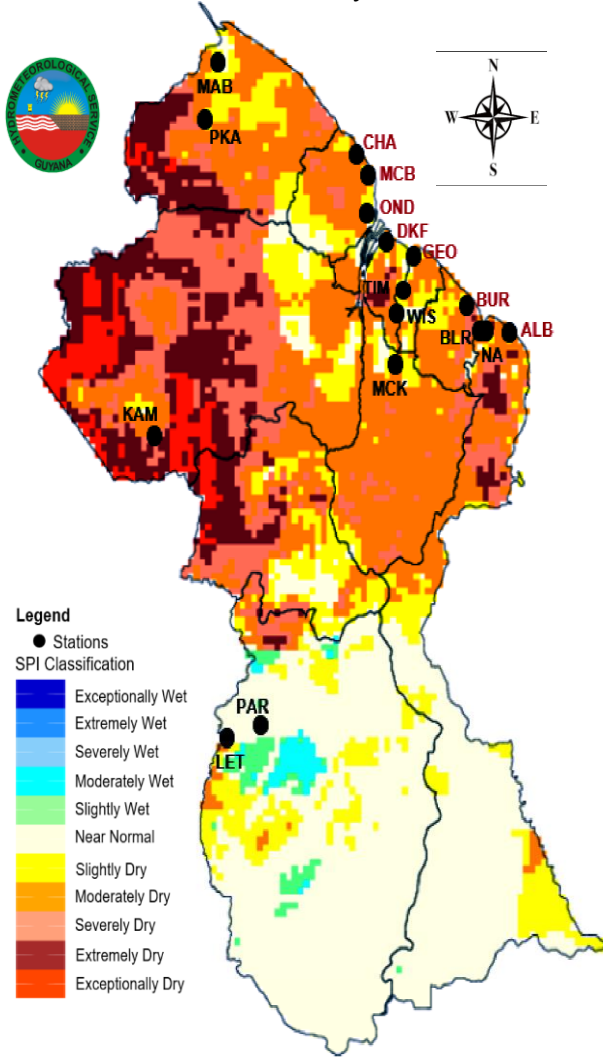


1-Month Standardized Precipitation Index (SPI)



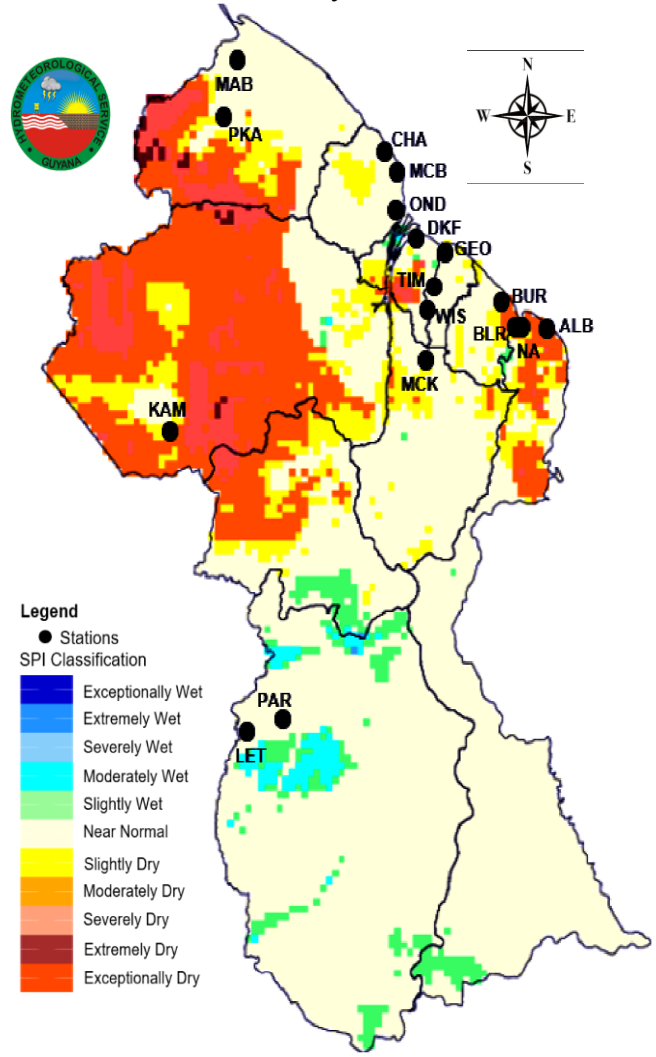
3-Month Standardized Precipitation Index (SPI)

## December 2019-May 2020



6-Month Standardized Precipitation Index (SPI)

## June 2019-May 2020



12-Month Standardized Precipitation Index (SPI)

#### STANDARDIZED PRECIPITATION INDEX (SPI) CLASSIFICATIONS

SPI Value	Category	SPI Value	Category
-0.50 to -0.01	Near Normal	0.50 to 0.01	Near Normal
-0.80 to -0.51	Slightly dry	0.80 to 0.51	Slightly wet
-1.30 to -0.81	Moderately dry	1.30 to 0.81	Moderately wet
-1.60 to -1.31	Severely dry	1.60 to 1.31	Very wet
-2.00 to -1.61	Extremely dry	2.00 to 1.61	Extremely wet
less than or equal to -2.01	Exceptionally dry	greater than or equal to +2.01	Exceptionally wet

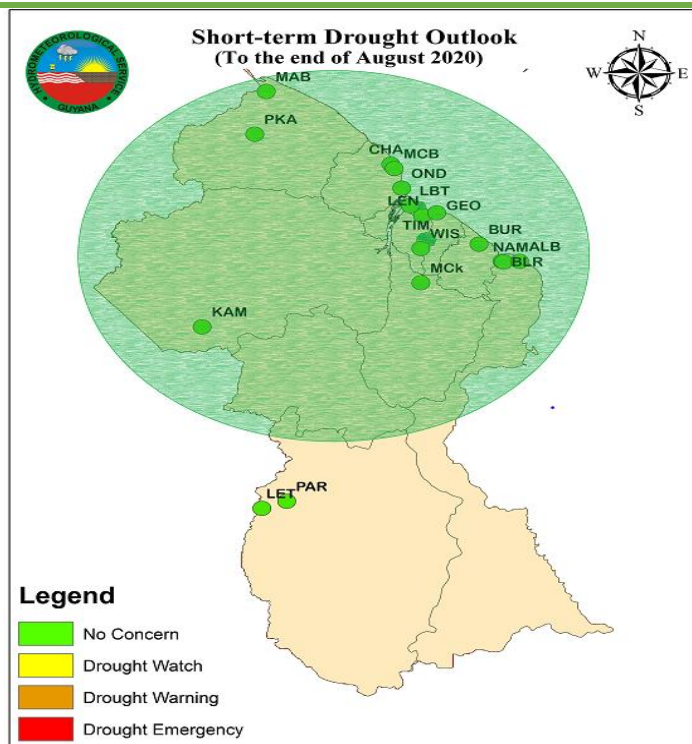
#### STATION ABBREVIATIONS

<b>PKA</b> -PORT KAITUMA	<b>OND</b> - ONDERNEEMING	<b>DKF</b> -DE KINDEREN FRONT	<b>ENM</b> - ENMORE	<b>BLR</b> - BLAIRMONT	<b>KAM</b> - KAMARANG	<b>ANI</b> -ANNAI
<b>WAU</b> -WAUNA	<b>UIV</b> -UITVLUGT	<b>LEN</b> -LEONORA	<b>TIM</b> -TIMHERI	<b>NAM</b> -NEW AMSTERDAM	<b>LET</b> -LETHEM	<b>EBI</b> -EBINI
<b>ANR</b> -ANNA REGINA	<b>DKB</b> -DE KINDEREN BACK	<b>GEO</b> - GEORGETOWN	<b>CGB</b> -CANE GROVE BACK	<b>PAR</b> - PARISHARA	<b>KUM</b> -KUMU	<b>MCK</b> - M <sup>C</sup> KENZIE
<b>WAL</b> -WALES	<b>ROH</b> -ROSE HALL	<b>SKL</b> -SKELDON	<b>BUR</b> - BURMA	<b>MAB</b> - MABARUMA	<b>CHA</b> -CHARITY	<b>BAR</b> -BARTICA
<b>KAI</b> - KAIETEUR	<b>KAM</b> -KAMRANG	-	-	-	-	-

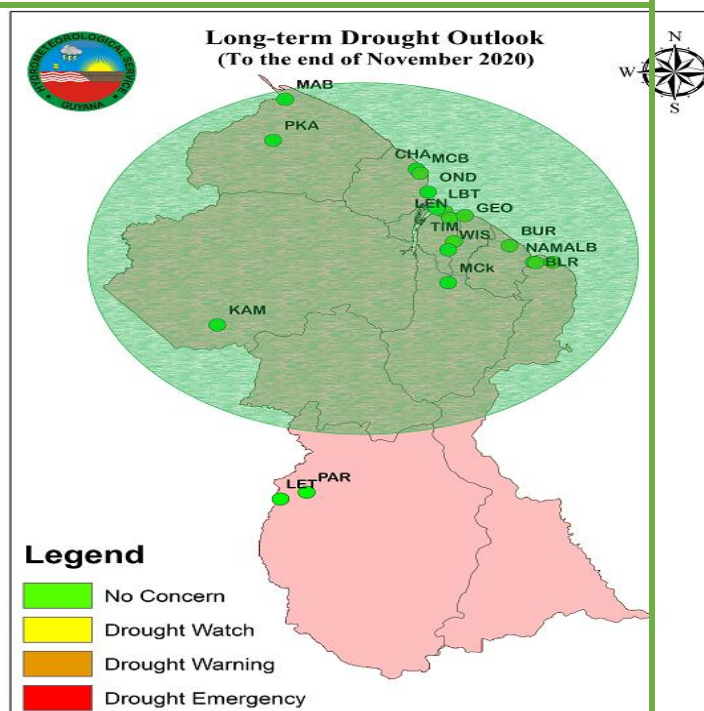


## DROUGHT OUTLOOK

Both the short and long-term drought outlooks are indicating no drought concern. We advise all stakeholders to keep monitoring drought and look for our monthly updates.



Short-term Drought Outlook by the end of August 2020 (Updated in May 2020- covering March to August 2020)



Long-term Drought Outlook by the end of November 2020 (Updated in May 2020 – covering December 2019 to November 2020)

**Note:** The 12-month SPI-based drought outlook (long-term) uses observations to forecast potential impacts **on large surface water reservoirs and groundwater**. While the 6-month outlook (short-term) can be used as an indication of effects on **agriculture**, etc.

#### ALERT LEVELS

Alert Levels	Meaning	Action Level
No Concern	No Drought Concern	<ul style="list-style-type: none"> <li>• monitor resources</li> <li>• update and ratify management plans</li> <li>• public awareness campaigns</li> <li>• upgrade infrastructure</li> </ul>
Drought Watch	Drought is Possible	<ul style="list-style-type: none"> <li>• keep updated</li> <li>• protect resources and conserve water</li> <li>• implement management plans</li> <li>• response training</li> <li>• monitor and repair infrastructure</li> </ul>
Drought Warning	Drought Evolving	<ul style="list-style-type: none"> <li>• protect resources</li> <li>• conserve and recycle water</li> <li>• implement management plans</li> <li>• release public service announcements</li> <li>• last minute infrastructural repairs and upgrades</li> <li>• report impacts</li> </ul>
Drought Emergency	Drought of Immediate Concern	<ul style="list-style-type: none"> <li>• release public service announcements</li> <li>• implement management and response plans</li> <li>• enforce water restrictions and recycling</li> <li>• enforce resource protection</li> <li>• repair infrastructure</li> <li>• report impacts</li> </ul>

Source: [caricof@cimh.edu.bb](mailto:caricof@cimh.edu.bb)

This bulletin is prepared by the Hydrometeorological Service of Guyana. We welcome feedback, suggestions and comments on this bulletin. Correspondences should be directed to The Chief Hydrometeorological Officer at [cho.guyana@gmail.com](mailto:cho.guyana@gmail.com) and the Agronomist at [agrodonessa@yahoo.com](mailto:agrodonessa@yahoo.com). You may also visit our website at [www.hydromet.gov.gy](http://www.hydromet.gov.gy). Tele#: (592)-225-9303 and Fax#: (592)-226-1460.

Figure 8: Drought Bulletin June 2020

Additionally, there are several regional organisations<sup>49</sup> that assist/can assist Guyana with drought monitoring and forecasting. See Appendix III.

<sup>49</sup> For more information see Guyana Drought Early Warning System Protocol (2015: 18).

### 6.3 Future Predictions and Analysis of Drought Events in Guyana<sup>50</sup>

Using the CariDRO<sup>51</sup> tool it was possible to: determine the occurrence of drought events in the recent history of Guyana; verify that reanalysis shows the events in numbers and by extension; determine potential recurrence of these events between 2020-2050.

In an effort to calibrate the model the analysis used to calibrate the model, 3 different lengths of 40, 60 and 90 years of data (not shown) from the Climate Research Unit (CRU). Based on the results presented in Table 9, it is concluded that the percentage of months below threshold (MBT) could triplicate in the near future 2020-2050 with respect to the baseline (1995-2010) for the Ensemble Mod that represent the A1B scenario. With regards to the RCP scenarios, the RCP 2.6 scenario presents a small increment in the number of MBT while there is a decrease for the other 2 scenarios. Regarding the number of droughts events (NDE) over Guyana, there is a small increase for RCP 4.5 and 8.5 scenarios while a decrease can be noted for the other two scenarios.

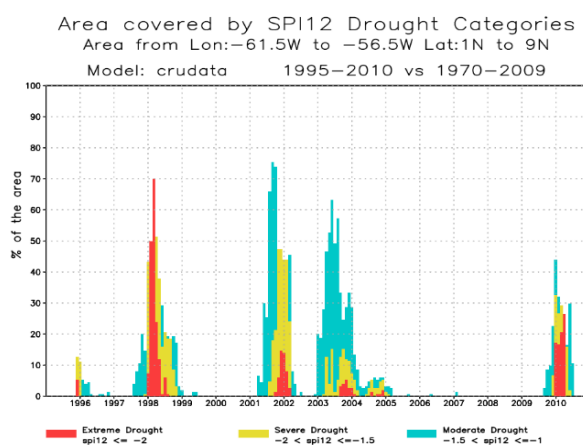


Figure 9: Area covered by SPI Index over Guyana

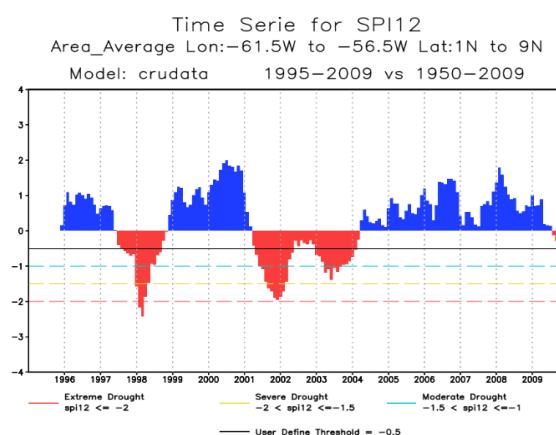


Figure 10: Time series for SPI12 Index over Guyana

Area covered by SPI Index over Guyana (left) for each of the drought categories, extreme(red), severe(yellow) and moderate(green) and time series for SPI12 Index over Guyana. Both charts using the Climate Research Unit (CRU) Datasets. Source: Guyana's TNC

<sup>50</sup> Information for this sub-section was obtained from the OCC as it was generated by the climate change vulnerability study, as part of the National Climate change A (something seems missing here)

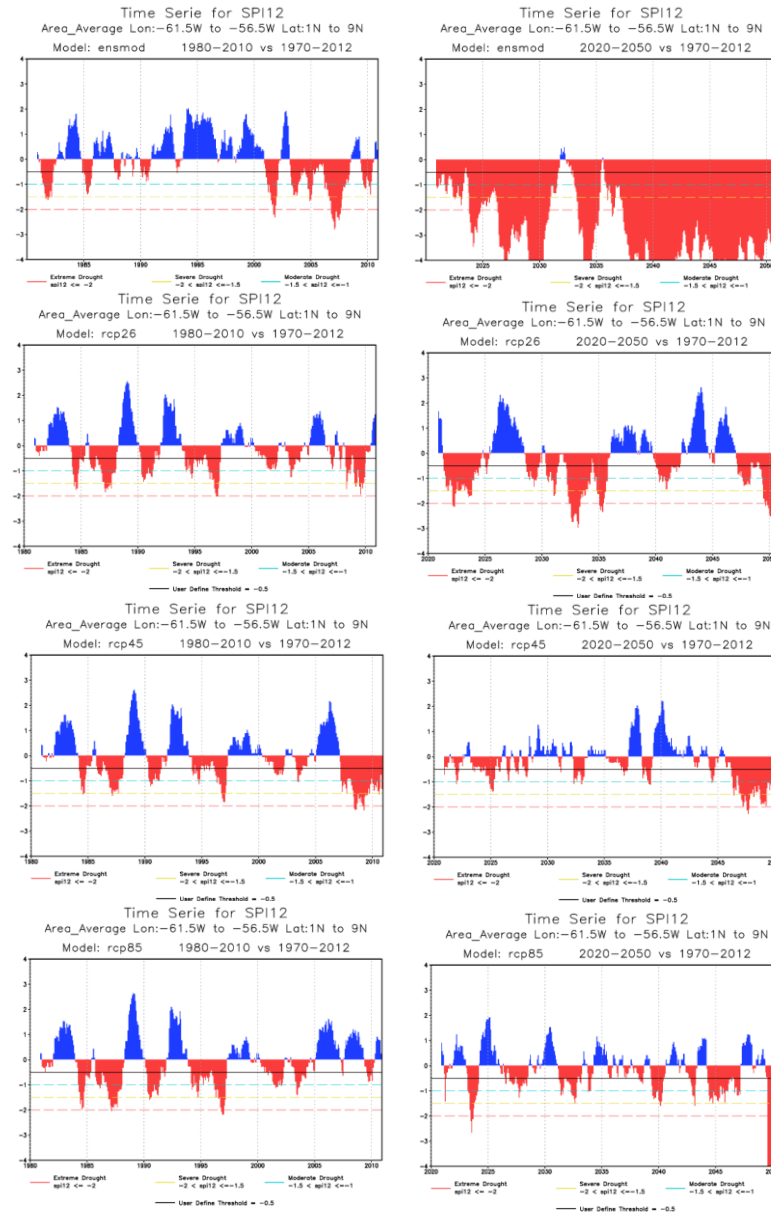
<sup>51</sup> <http://caridro.caribbeanclimate.bz/modelling-tool/>

**Table 9: Mean values over Guyana for different drought characteristic**

SCENARIO	MBT- Months below Threshold	% of Area Covered	NDE Number of drought events	CM continuous months within a drought	MOD number of moderate droughts events in the period	SEV number of severe droughts events in the period	EXT number of extreme droughts events in the period
RCP 2.6	144	40	14	41	12	6	4
	175	49	9	58	18	8	11
RCP 4.5	139	38	12	31	12	6	4
	119	33	19	53	10	4	4
RCP 8.5	131	36	14	45	12	5	4
	128	36	17	30	14	1	8
ENS-MOD	111	31	15	28	10	9	6
	341	94	4	97	12	7	74

Mean values over Guyana for different drought characteristic, from left to right months below threshold, % of area covered, number of droughts events, continuous months within a drought, and number of moderate, severe and extreme droughts events in the period. First row are the present conditions and second row are the future conditions for each scenario. Source: Guyana's TNC

For the continuous months within a drought (CM), the increase value for the A1B scenario triplicates in the near future, while it has a moderate increase for RCP 2.6 and 4.5 scenarios and a decrease for the RCP 8.5 scenario. The table also shows that the number of moderate events increase for all scenarios with the exception of RCP 4.5, the number of severe events increase for scenario RCP 2.6 but decrease for all the other scenarios and the number of extreme events increase dramatically for scenario A1B while it increases in scenarios RCP 2.6 and 8.5 and remain the same for scenario RCP 4.5.



**Figure 11: Time series for SPI index from 2020 to 2050 and from 1980 to 2010 using as a calibration period the 1970-2012 from top to bottom the ensemble of models represent the A1B scenario and RCP 2.6, 4.5 and 8.5.**

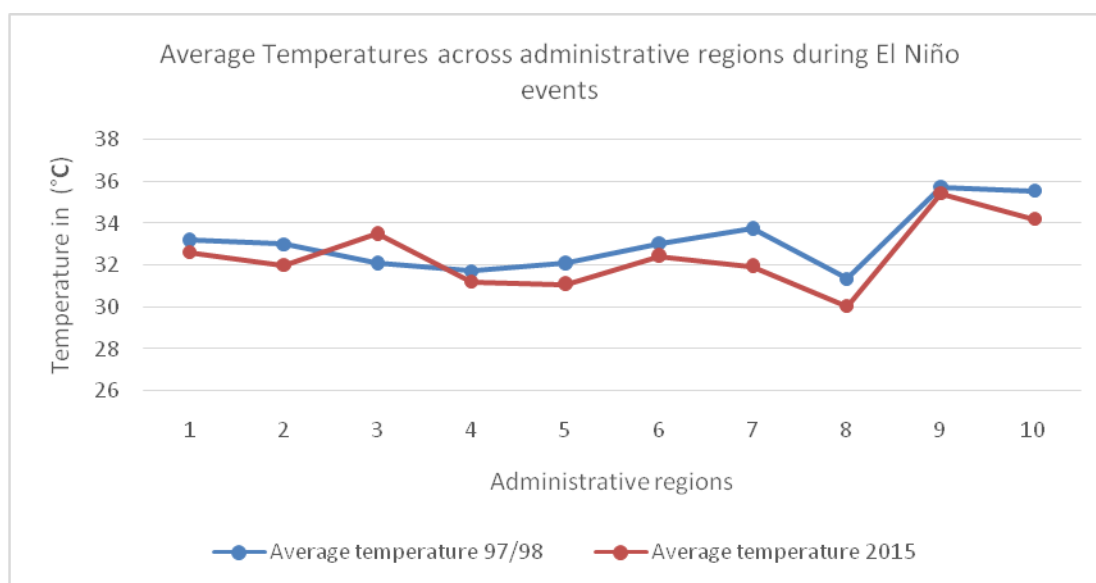
Source: Guyana's TNC

It is noteworthy that even though there is not going to be more frequent droughts, the future drought events will be longer, and also the number of extreme drought events will also increase.

## 6.4 Drought Severity by sector

Assessing drought severity is a critical element of drought monitoring. Currently, there is no nationally driven and organized assessment of drought severity in Guyana.

An independent study conducted by Hamer, David, Lanferman and Peters (2017), using the Standardized Precipitation Index, clearly indicated more severe drought patterns during the 1997/98 El Niño as compared to the 2015/16; also, in addition to the higher average temperatures recorded it can be concluded that the 1997/98 El Niño was stronger than the current. It is also noted that the severity of the El Niño of 2015 - 2016 over the 1997 - 1998 weather event has been established by NOAA, and expressed in its El Niño Index of 3.0 for November 2015, versus an index of 2.8 for 1997.



**Figure 12: Graph depicting temperatures recorded during the 1997/98 El Niño vs 2015**

Source: Hamer, David, Lanferman and Peters (2017)

## 6.5 Impact Assessment

The CDC has adopted the application Damage Assessment and Needs Analysis (DANA). Thus, three documents were prepared in 2010: The Damage Assessment and Needs Analysis Framework, the Damage Assessment and Needs Analysis Policy Statement, and the Damage Assessment and Needs Analysis Plan<sup>52</sup>. Basically, *DANA is the process by which the extent of damage, following a major hazard impact, is defined by the collection and analysis of damage information, which is used ultimately to determine the needs of victims and the strategies to provide appropriate assistance to restore the affected area to a sense of normality in the shortest possible time. This Damage Assessment & Needs Analysis (DANA) Plan is therefore an annex of the Guyana Multi-hazard Disaster Plan and outlines the framework within which damage assessment is carried out.*

<sup>52</sup> This Plan derives its authority from The National Disaster Preparedness Plan of Guyana (1985), and the Cabinet Note of 1997 reconstituting the CDC, as the plan is managed by the CDC.

The DANA Plan (2010) provides a systematic approach for conducting damage assessment and determining needs in an effective and time sensitive manner to influence response and recovery actions in Guyana. It establishes a number of Damage Assessment Teams (the type and magnitude of the event will determine the team deployed). The teams are: a) Rapid Damage Assessment Team; b) National Damage Assessment Team; c) Regional Democratic Council (RDC) Damage Assessment Team; and d) Sector Assessment Team.

The roles and responsibilities of the Rapid Damage Assessment Team are as follows:

- a) Confirm the reported emergency and estimate the overall magnitude of the damage
- b) Identify, characterize and quantify populations at risk in the disaster
- c) Identify and classify type of damage
- d) Identify access routes and the levels of entry into the affected areas
- e) Identify damage to critical buildings, infrastructure/facilities
- f) Estimate the extent of the damage
- g) Identify existing and potential threats

The Damage Assessment process is comprised of data gathering and collation, data analysis, synthesis and interpretation, needs and resources quantification, and reporting.

To date, no DANA for drought hazards have been undertaken for Guyana.

## 6.6 Constraints and Challenges

- SPI values need to be more fitted to local conditions to enhance preparedness and mitigation measures. There is definitely a paucity of data. According to the Guyana Drought Early Warning System Protocol (2015: 18). *An option for the DEWS is Guyana doing its own analysis of weather data. But this is high science that requires extensive years of data on temperature of the Pacific and Atlantic oceans and of the atmosphere on a large surface of the Earth, and complex computational models that require super computers to process. Guyana is a small country with limited resources.*
- There is need for improved monitoring and documentation of drought impacts.
- There is need for the use of common and scientifically robust indicators in keeping with the Drought Resilience, Adaptation and Management Policy (DRAMP) Framework DRAMP Technical Guidelines.
- Limited technical capacity of staff of the Hydromet in the area of drought prediction, forecasting and vulnerability and risk assessment.
- Limited collaboration/feedback between Hydromet and other agencies impedes more effective drought monitoring and impact assessment.
- There is limited documentation on drought events: losses and implications, plus lessons learnt to inform the planning process.
- Guyana has no standardised impact assessment methodology for droughts.

## CHAPTER 7 DROUGHT RISK AND VULNERABILITY

### 7.1 Preamble

Effective drought management necessitates the understanding of the likely impacts, who will be at risk, and why. Further, assessing risks and vulnerability before droughts occur allows decision-makers and communities to devise measures that reduce and prevent the worst impacts<sup>53</sup>.

The current protocol recorded by the CDC is as follows: After the summoning of stakeholders, the CDC should have sufficient data to perform a vulnerability analysis. The CDC, along with the other entities of the National Government shall draw up a “vulnerability analysis”, the result of which will guide the development of preventive and mitigating measures to deal with the coming drought.

It must be underscored that a country must be first able to monitor and analyse trends in (i) the proportion of land under drought and over the total land area; (ii) the proportion of the population exposed to drought as a percentage of the total population prior to establishing the degree of drought vulnerability<sup>54</sup>.

According to the UNCCD website <https://knowledge.unccd.int/sites/default/files/2019-04/Model%20Drought%20Plan.pdf>) the two dominant vulnerability definitions/frameworks are:

- (i) From the disaster risk reduction community: The conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards (UNISDR 2015); and
- (ii) From the climate change adaptation community: The degree to which a system is susceptible to, or unable to cope with, adverse effects of drought. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity (IPCC 2014).

The vulnerability analysis should entail three integrated steps:

Step 1- Define the components of drought vulnerability: build a conceptual framework and clarify definitions;

Step 2- Select variables and normalize;

Step 3 Model validation through a weighting and sensitivity analysis, and comparison with other indicators.

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<sup>53</sup> See [http://catalogue.unccd.int/1247\\_UNCCD\\_EN\\_Web.pdf](http://catalogue.unccd.int/1247_UNCCD_EN_Web.pdf)

<sup>54</sup> The diversity within drought vulnerability studies is extremely high, and there is a lack of common conceptual understanding of vulnerability, standardized methodology, and common vulnerability metrics.  
<https://knowledge.unccd.int/sites/default/files/2019-04/Model%20Drought%20Plan.pdf>



A popular formula for calculating vulnerability is: Vulnerability (V) = Exposure (E) + Sensitivity (S) – Adaptive Capacity (AC).<sup>55</sup>

The purpose of vulnerability analysis is to provide government with an effective and systematic means of assessing drought impacts, developing mitigation actions and programs to reduce risk in advance of drought, and developing response options that minimize economic stress, environmental losses, and social hardships during drought. It is envisaged that once data collection and monitoring are normalized in Guyana, robust vulnerability assessment will be conducted.

## 7.2 The Drought Risk and Vulnerability Assessment and GIS Mapping

The Guyana Lands and Surveys Commission (GLSC) has produced a range of valuable maps at a national level, for example, a national assessment on land degradation and drought. Past work as presented in this report were a Drought Early Warning System and a Drought Early Warning System Protocol. See details in Figure 12. This sort of spatial planning aids in providing a better picture of drought vulnerability areas, thereby informing the overall planning process.

Given the absence of methodology to conduct vulnerability analysis of hazards, the CDC (2014:47) provides a useful approach that should be adopted by all stakeholders involved in vulnerability assessments. In fact, the document states that *for upcoming vulnerability assessments, different components of vulnerability should be incorporated into the analysis*:

- i. **Social vulnerability-** With consideration to age patterns, poverty, unemployment, education, health conditions, gender differences, disability, population density and living arrangements, effects of migration in social support networks, etc. Gender sensitive analysis of drought is necessary given that women/girls face disproportionate exposure, sensitivity and adaptive capacity as compared to boys/men.

The importance of gendered studies on drought impact is supported by several studies around the world. For example, Sahu (2019) in her study titled *Coping with droughts: Gender Matters*, highlighted the following:

- Women were hit the hardest due to lack of clean water and changes in diet. They suffered from a range of health problems such as fever, weakness and reproductive health issues.
- Drought-induced crop and income losses forced many women, especially from poor tribal areas to take up less productive and low-remunerative activities such as

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<sup>55</sup> Specific details are provided online at <https://knowledge.unccd.int/sites/default/files/2019-04/Model%20Drought%20Plan.pdf>.

subsistence farming, collecting forest produce, undertaking seasonal works and participating in public employment programmes.

- Women bore a greater share of the work burden by working extended periods of time, undertaking more tasks and engaging children in economic activities. Many a time, it was the girl child who helped the mother with her household tasks leading to her absence from school and outdoor activities.
- The responsibility of looking after the household members such as elderly and children and coping with food shortages had to be totally managed by the women as men migrated out in search of jobs.
- Women from poor and landless households faced maximum food insecurity and tried to cope with it by exploring various means to access food like collecting it from forests, rivers, water bodies etc depending on seasonality, availability and access.

The FAO (2018)<sup>56</sup> provides a list of questions to structure gender sensitive vulnerability assessments. The same can be done specifically for drought vulnerability assessments in Guyana.

- ii. **Physical vulnerability-** Influenced by dwelling exposure, infrastructure, building materials and conditions, construction standards, mangrove areas, sea and river defence and conservancies maintenance conditions, drainage capacity, etc. The Poverty Reduction Strategy pointed out that the increased pressure on land resources in the coastal plain made the development of a land use policy and plan crucial.
- iii. **Environmental vulnerability-** Shaped by waste management systems, pollution and disposal of hazardous chemicals, water and sanitation conditions, sea and river defence conditions, land management, soil degradation, deforestation, and biodiversity, amongst others.
- iv. **Economic vulnerability-** Dependency on limited range of income sources and rising costs of food and fuel, low insurance use, and high exposure of economic wealth and infrastructure in the hazard prone areas increase the vulnerability of the population at risk.
- v. **Political vulnerability-** In particular the degree of integration of DRM considerations into development planning at the local, sub-national and national level, and the enforcement of regulations.
- vi. **Effects of climate change on vulnerability,** and in particular its effects on livelihood.

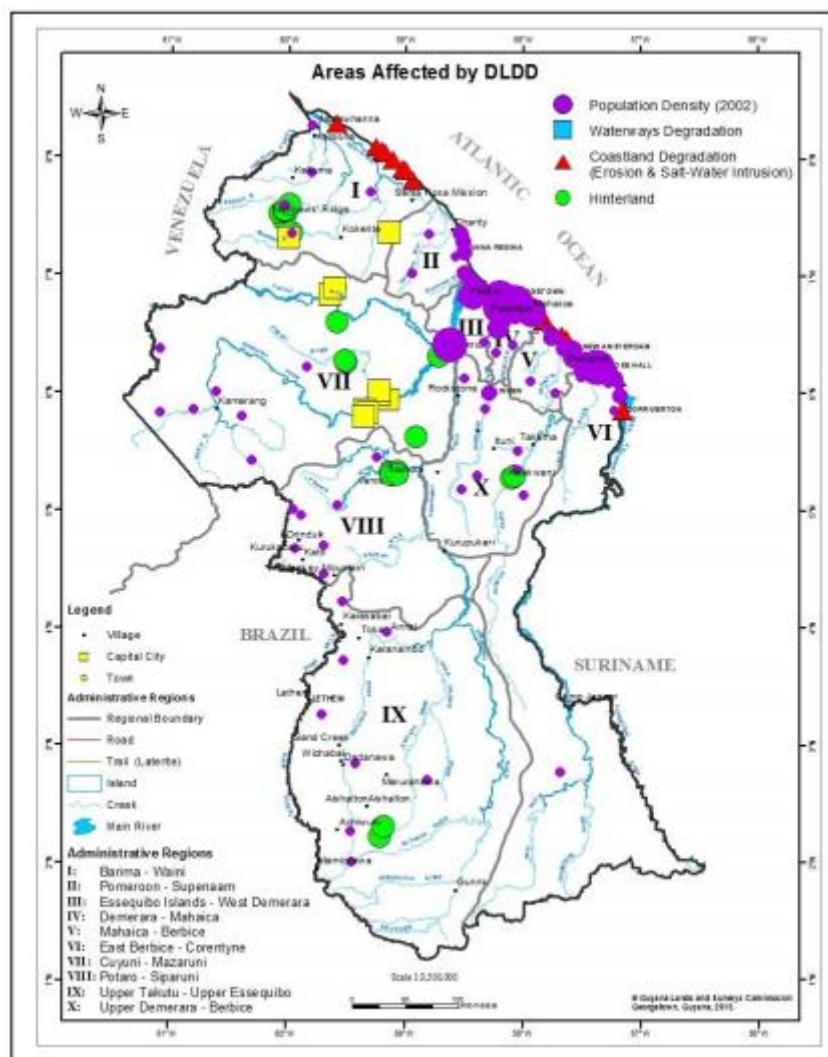
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<sup>56</sup>See <http://www.fao.org/3/i7654EN/i7654en.pdf>

### 7.3 Drought Risk Areas in various regional administrative areas

Due to the absence of detailed statistics on demographic variables (for example, poverty level) of the Guyanese population, drought risk areas can only be identified in the desertification, land degradation and drought analysis that was undertaken by the GLSC, as depicted below in Figure 13<sup>57</sup>. By and large, there is a general overlap between population density and drought affected areas; however, statistics on such parameters as exposure to the hazard, population's sensitivity to the hazard due to socio-economic conditions, and their coping capacity may change the spatial dynamics of drought in Guyana.

A popular formula for calculating risk: Risk = Vulnerability X Hazard<sup>55</sup>.



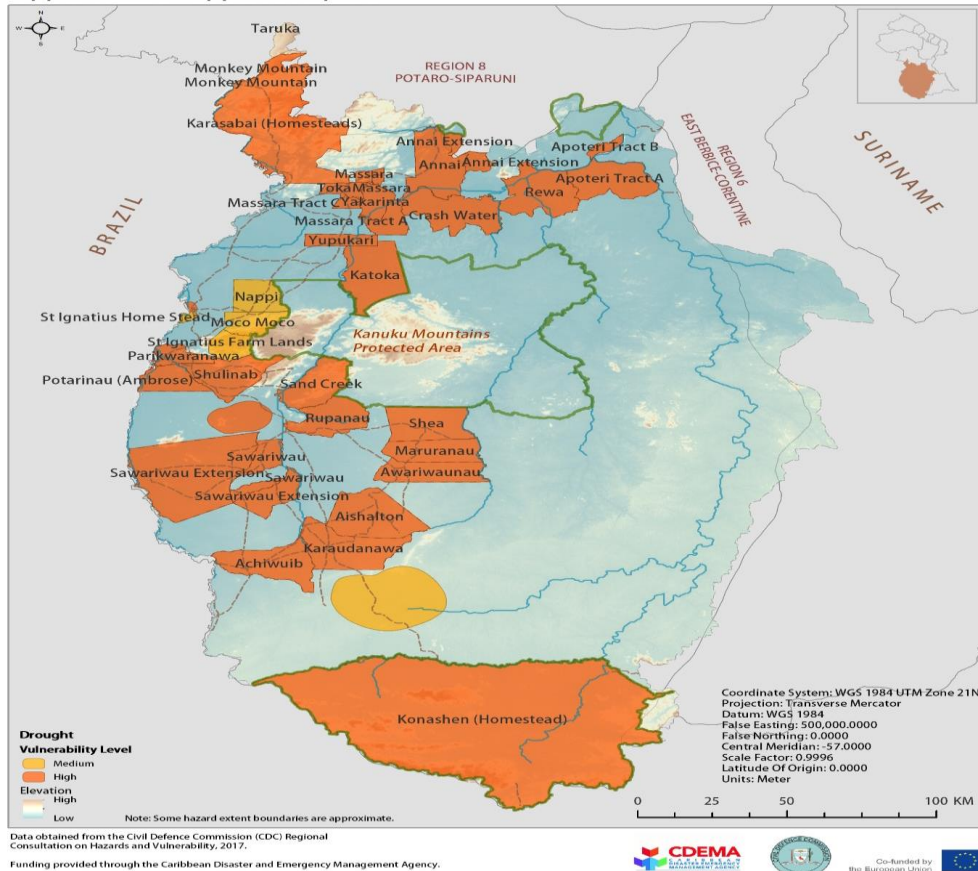
**Figure 13: National Assessment on Land Degradation and Drought**  
Source: GLSC

<sup>57</sup> (Guyana) Aligned National Action Plan to combat Land Degradation, 2015.

In 2017, the CDC commissioned a Hazard and Vulnerability Analysis of the Upper Takutu-Upper Essequibo Area (Region 9) in Guyana. The study, conducted by Drakes and Benn, consisted of identification, probability of occurrence estimation, risk assessment (hazard x vulnerability/coping capacity (considered as resilience) in which severity was rated across a number of categories on a 1 to 10 range from low to high as follows: 1-3 = low; 4 -7 = moderate; and 8 -10 = high. Vulnerability was evaluated on three sub-categories-human impact, property impact and business impact, all based on perceived exposure. Maps were utilized to display results. Analysis of loss and Damage-Vulnerability Assessment were then conducted, utilizing the maps and matrices were developed in the previous steps, and facilities at risk and the extent to which these might be affected were analysed. See Figure 14 below.

The study revealed that the historical frequency of droughts has averaged 1 events every 10-12 years, while drought *like conditions are more common, occurring on average about every 4-5 years, and that the temporal spacing is linked to dry periods and intense ENSO events. Moreover, spatially, the entire Region 9 is affected although subsistence agricultural communities and those relying on cattle ranching are more severely impacted* (CDC, 2017: 35).

## Vulnerability to Drought Upper Takutu - Upper Essequibo



**Figure 14: Hazard and Vulnerability Analysis of the Upper Takutu-Upper Essequibo Area (Region 9)**

### 7.4 Constraints and Challenges

The current constraints and challenges to drought risk and vulnerability assessment and GIS mapping are as follows:

- Absence of several years digitized data for various weather stations;
- Quality of data, and in particular: to the lack of systematic data collection, to low levels of disaggregation of data, and to the time lapse between the collection and release of data;
- Absence of detailed statistics to facilitate vulnerability analysis and mapping;
- Need for training is needed in the use of other drought monitoring indices that will complement the SPI and also in GIS;
- Validation of the SPI computed given that historical records of impacts cannot be easily located; and
- Limited or non-existent disaggregation of socioeconomic and gender data.

CHAPTER 8 DROUGHT COMMUNICATION AND RESPONSE ACTIONS

8.1 Drought Communication Protocol

A Drought Early Warning System is a system for monitoring drought to provide timely information for decision makers to take measures to mitigate the impact (Protocol for Drought Early Warning System, 2015). Eighty percent of the success of a DEWS depends on the capacity of the country to detect a drought several months in advance, allowing the dissemination of the news and preparedness to mitigate the effects. The early warning component of a drought plan is essential because it provides the foundation on which timely decisions can be made by decision makers at all levels.

A drought protocol has three components: monitoring and early warning; risk assessment; and mitigation and response. See Figure 15.

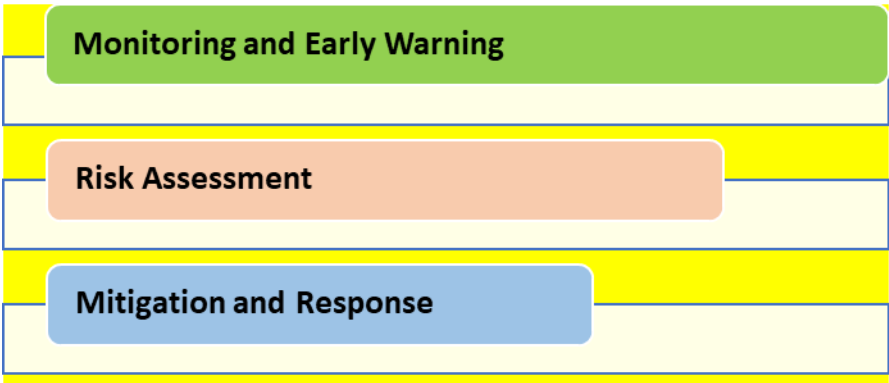
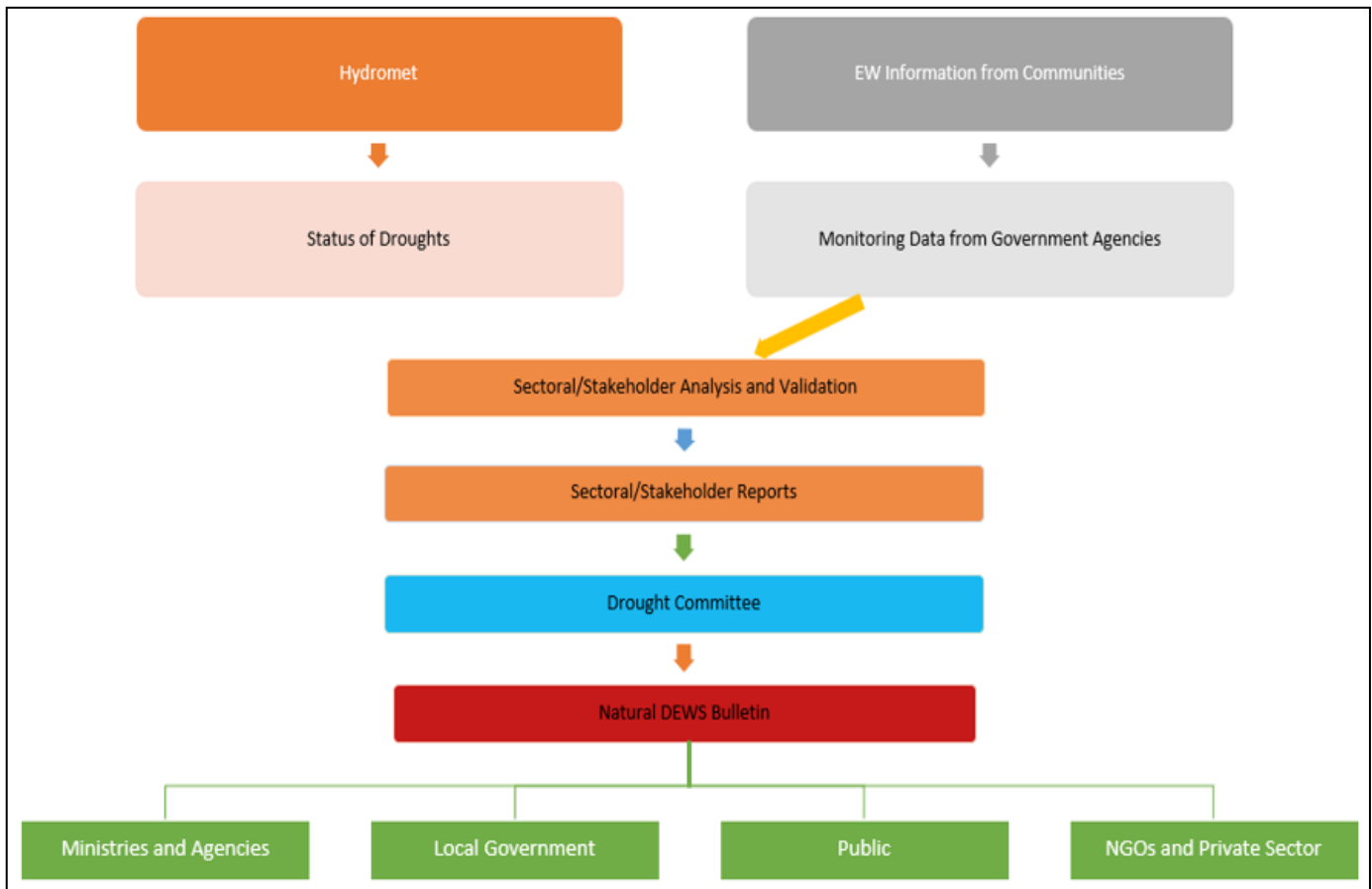


Figure 15: Three components of a Drought Protocol

The goal of the Drought Communication Protocol (Figure 16) is to allow the authorities to disseminate information in a timely manner for response actions to be taken to reduce or mitigate the impact, whereas its purpose is to protect lives and livelihoods from droughts, minimizing negative impacts on economy and environment.

*The DEWS should be able to detect emergence of rainfall deficits which is normally the best indicator of approaching drought period. Effective drought early warning requires the adoption of a protocol that includes the application of tools and indices in monitoring and forecasting and evaluation of potential impacts in specific sectors. It includes mechanisms and procedures for the collection and analysis of data and dissemination of the early warning messages on drought onset, progression, end, and severity to a broad group of users in a timely manner so that it can be applied in decision making.*



**Figure 16: A Simple Model for the DEWS Protocol for Guyana**

Source: Protocol for Drought EWS, 2015

## 8.2 Declaration of Drought Conditions

The Hydrometeorological Service has the mandate to advise policy makers of any drought which has occurred or which is likely to occur. As mentioned earlier in Chapter 3, Part VI of the Guyana Water and Sewerage Act (2002) states that if the subject Minister (Agriculture) is satisfied with the advice provided by the Hydrometeorological Service or *‘otherwise that a serious deficiency of supplies of water in any area exists or is threatened, then, subject to the provisions of this Part, he may by order make such a provision with a view to controlling the amount of water demanded and minimizing the economic and environmental impact of the deficiency* (Part VI, 38 (1). Further, a drought order may have effect for a period of up to three months, and can be extended by the Minister by subsequent order for an additional period that does not exceed three months.

The recommended practice for Guyana is that the Hydrometeorological Service will advise policy makers of any drought which has occurred, or which is likely to occur. Importantly, after the Hydrometeorological Service receives two communications from overseas institutions' warning on the possibility of drought in the coming months, the agency shall report the fact to a Drought Committee, formed by the organs of the Government that has a direct interest in the subject (See Figure 15).

Additionally, the EWS Framework (2013:11) states that: *"Warnings need to be sent out to those members of the public who are at risk. Messages should be clear and simple, containing useful information that is critical to enabling a proper response. The use of multiple communication channels is necessary to ensure that as many people as possible are warned, to avoid the failure of any one channel and to reinforce the warning message"*.

### 8.3 Communication and Coordination Practices

It is suggested that the Hydrometeorological Service function as the Focal Point for receiving drought forecasting from abroad (See Sub-section 8.2).

#### 8.3.1 The Drought is Coming

The Hydrometeorological Service has the mandate to advise policy makers of any drought which has occurred or which is likely to occur. After the Hydrometeorological Service receives two communications from overseas institutions warning (for example CIMH or the Centre for Weather Forecasting and Climate Research; see Appendix IV has additional information) or the usual source on the possibility of drought in the coming months, it should report the fact to the Drought Committee. When a meteorological drought is detected, before a drought period is declared, the Committee should, in a meeting, analyse the situation, based essentially on the water storage levels in some reservoirs, particularly multi-purpose reservoirs and the imbalance between water availability and water demand prediction. If the decision of the Committee is for the presence of a drought, this Committee shall propose to the Government to declare a "State of Potential Drought" and a Drought Mitigation Plan should be drawn up. The Committee must make its information accessible and easy to interpret, and it must deliver a clear, consistent message to decision makers so that they can act on this information.

#### 8.3.2 Dissemination of the Information

People need to be warned of coming drought as soon as it is detected, but often are not. Information needs to reach people in time for them to use it in making decisions. In establishing information channels, the Drought Committee needs to consider when people need various kinds of information. Based on the information received and the approval of the Ministry of the Presidency (then the Office of the President), the Civil Defence Commission (CDC) shall prepare public advisories to be disseminated through the various communication means: print, radio, television, mobiles, internet, etc. As the dissemination about drought needs a skilful entity which knows how to interact with the population, it is suggested that the dissemination of the drought forecast be done by the CDC, in coordination with the Department of Public Information. It is important to highlight that one, and only one body should be



responsible for the dissemination of drought warnings to other stakeholders. The CDC shall assemble a list with email addresses and phone numbers of all entities, from the government and civil society, which have a stake in programs for the mitigation of the effects of the drought.

When a State of Drought is declared, all entities on the list will be informed by telephone, email, text, WhatsApp and other media about the fact. All stakeholders shall be informed. The press, NGOs and social networks should be part of the list of entities that will receive the alert. Each stakeholder should have a focal point, whose function will be to receive and internally disseminate the information received from CDC within his/her organization. As there is no formal system to determine whether advisories were actually received by the general population, the messages should be accompanied by a warning such as "if you do not reply that you have received this message, your organization will be disconnected from the drought forecasting system". Only high probability of droughts messages should be publicly disseminated. The extent of the risk is usually determined by meetings among the relevant agencies. Although low and medium probability messages are generally avoided, as there are no existing criteria for the determination of the magnitude of a particular risk, it is recommended that these low and medium probability messages be disseminated, at least, within the governmental institutions. The CDC is already making progress in incrementing the use of computer technologies for communications, but an Information and Communication Technologies (ICT) policy and stronger human capacities are needed.

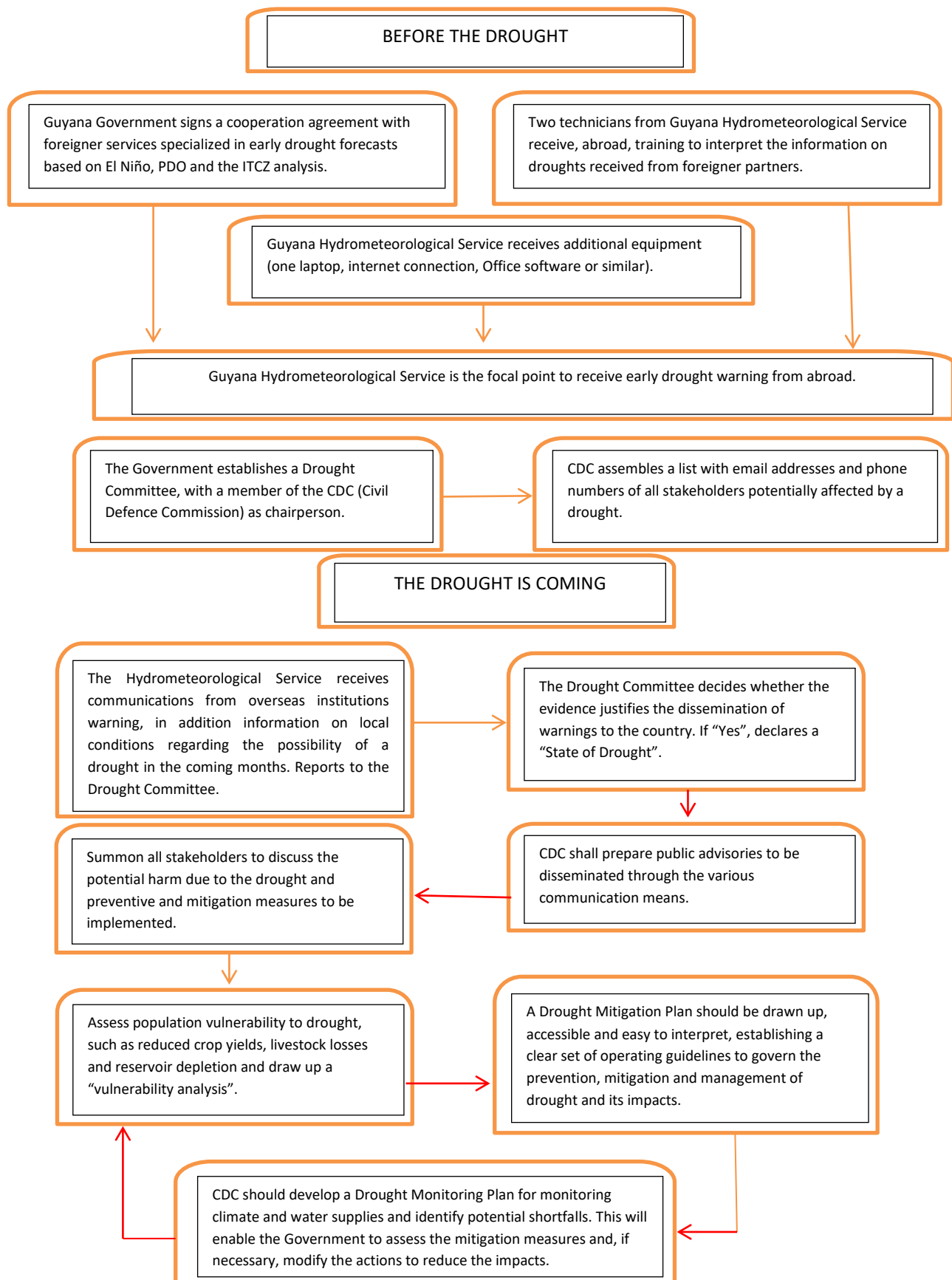
#### 8.3.3 The Role of the Civil Defence Commission

The Civil Defence Commission (CDC) plays the lead role in national disaster preparedness and response. CDC chairs the National Disaster Platform which has the participation of all key agencies and stakeholders. At the local level there are ten (10) Regional Democratic Councils (RDCs) that are responsible for preparing their respective disaster preparedness and response plans under the supervision of the CDC. The preparedness and response plans of the RDCs also include the community-level (Neighbourhood Democratic Councils). As it is a technical entity which deals more closely with droughts, and for the sake of speed dissemination, it is recommended that for a DEWS, the CDC be the authorizing body for issuing the warning, which contradicts with the current national EWS Protocol. CDC has a small staff base, however, with training and more resources it can be the leader on information on drought forecast. It is recommended that the CDC improves the Multi-hazard EWS, which has little mention of drought, through the adoption of this proposed DEWS.

#### 8.3.4 Summoning all Stakeholders

In practical terms, after an alert of possible drought is released, meetings with all stakeholders should be summoned to discuss the potential harm due to the drought and preventive and mitigation measures to be implemented. The meetings should be held in the most practical venue, for example, the Capital, and should have the participation of representative leaders of various economic and social sectors. The purpose of the meetings is to inform about the possibility of a new drought, get reports about the losses suffered in previous droughts, and ask for suggestions on how to mitigate the impacts of the next drought. Stakeholders should include government agencies, businessmen's and farmers' associations,

NGOs, social movements, representatives of the ten Regions and municipalities, among others. Figure 17 illustrates the proposed drought coordination practice for Guyana as illustrated in the DEWS Protocol (2015). It is noteworthy that the possibility of a drought does not depend only on information from overseas institutions, since local conditions are monitored and models are run for the same.



**Figure 17: Drought Coordination Activities**

Additionally, Guyana is a member of the Caribbean Drought and Precipitation Monitoring Network (CDPMN) that was established as part of the Caribbean Water Initiative (CARIWIN) Project. Such a mechanism allows for agencies in Guyana, such as the National Drainage and Irrigation Authority, Civil Defence Commission, and other entities that report to the Ministry of Agriculture, as well as Extensions Officers to access relevant information.

Guyana benefits significantly from outlooks produced by the Caribbean Regional Climate Centre whose goal is to provide some insight into what is likely, the CariCOF Dry Spell outlook gives the probability, via maps, of having at least three 7-day and at least one 15-day dry spell, as well as the maximum number of 7-day and 15-day dry spells. It also provides a tabulated comparison of the average number of 7-day, 10-day and 15-day dry spells.

These outlooks are produced by CariCOF for the upcoming three-month period and updated monthly. For a better picture of the rainfall characteristics for the upcoming period, the dry spell outlook should be used in conjunction with other CariCOF outlooks, including the precipitation, drought and wet days/wet spells outlooks.

#### 8.4 Drought Response Actions by Organisation and/or Sector

Table 10 provides a brief description of the drought response measures that have been taken by national organizations/sectors.

**Table 10: Drought Response Measures**

<b>Organizations/Sectors</b>	<b>Drought Response Actions</b>
<i>Civil Defence Commission</i>	<ul style="list-style-type: none"> <li>- Establishment of an El Niño Committee and convening of meetings (for example in February 2016) to determine what resources are available and how best we can apply those resources to address how the affected communities (particularly in agricultural areas).</li> <li>- Rapid regional assessments are conducted and key issues and challenges are identified. Subsequently, relief and support are coordinated. For example, in June 2016 a quantity of food supplies was provided to help residents who were affected by the prolonged drought in sections of Region Nine. In other communities, residents were given buckets and filters, 450-gallon water tanks.</li> <li>- Provision of water pumps. CDC has been proactive in digging wells in the deep South Rupununi sub-Region.</li> </ul>
<i>Guyana Geology and Mines Commission</i>	<ul style="list-style-type: none"> <li>- Provision of potable water to hinterland residents on a small scale</li> </ul>
<i>Guyana Livestock Development Authority</i>	<ul style="list-style-type: none"> <li>- Extension officers sensitise farmers through seminars on conservation measures, for example, storage of grass and silage.</li> <li>- Reinforcement/enforcement of the Food and Agriculture (FAO) Livestock Emergency Guidelines and Standards.</li> </ul>

<i>GRDB</i>	<ul style="list-style-type: none"> <li>- Advocate for water allocation which is executed by the Water Users Association (WUA) that falls under the National Drainage and Irrigation Authority</li> </ul>
<i>GuySuCo</i>	<ul style="list-style-type: none"> <li>- All estates and farmers are informed and control infrastructure is activated.</li> <li>- Installation of navigation canal stop-offs: These are put into the navigation system, if necessary, at the commencement of 2<sup>nd</sup> crop to effectively control the flow of water in the main cane transport channels to ensure floatation of punts. It also ensures that water is maintained in blocks that have to be harvested and reduced from blocks to be harvested in the alternate crop or later on in a particular crop.</li> <li>- Linking of the Estate Drainage system with that of Mahaicony Rice Limited: This was also done in the 1997/1998 El Niño. The drainage system of the rice lands adjacent to the Expansion lands was linked into the Expansion side-line so that drainage water from the rice lands could be pumped into the Estate navigation system.</li> <li>- Re-circulation of all drainage water based on salinity test.</li> </ul>
<i>GWl</i>	<ul style="list-style-type: none"> <li>- Policy change at highest levels and mainstreaming climate resilience in all development projects from the conception stages during planning and budgeting in collaboration with the Ministry of Finance.</li> <li>- Rainwater harvesting, Wastewater reuse linked to building codes.</li> <li>- Development of pipe distribution networks from wells to homes in the deep South Rupununi.</li> <li>- Alternative water sources and redundancies. Watershed and ground water protection.</li> <li>- Guyana, through the OCC in collaboration with the GWl, has already prepared and submitted a proposal that aims to improved access to water in drought-prone rural communities in Guyana. Basically, the expected results are (i) Approximately 762 men and 699 women with improved access to water that meets international drinking standards; (ii) 12,000 gallons of increased storage capacity with meets international drinking water standards; and (iii) 15 persons trained -6 community members, 5 GWl staff, 2 technical officers from OCC and 2 from Regional Authorities (at least 5 women) received training in climate change adaptation principles and techniques related to installation and maintenance of community-based water systems.</li> <li>- Additionally, a Geophysical logging project was undertaken in response to GWl's mandate to equitably provide access to potable water to Hinterlands communities nationwide. The geophysical logging exercise relates to the planning of the proposed drilling of numerous wells in 7 communities earmarked for urgent interventions, with the objective of establishing sites for drilling deep wells for water withdrawal.</li> </ul>

<i>MMA-ADA</i>	<ul style="list-style-type: none"> <li>- Advisory is sent to farmers.</li> <li>- Pump irrigation, using sprinkler pumps, is encouraged.</li> <li>- Farmers are sensitised about the conservation of water.</li> <li>- Water rationing: 2 days for one block and 2 days for another block for riverain areas.</li> <li>- Fresh water at Kuliserabu Creek is activated.</li> <li>- Barriers are used at points (for example, Perth<sup>58</sup>) where saline intrusion occurs.</li> </ul>
<i>Ministry of Public Health</i>	<ul style="list-style-type: none"> <li>- Health education talks in communities, schools, and health centres are conducted.</li> <li>- Brochures are developed and distributed.</li> <li>- The Ministry of Public Health collaborates with the Civil Defence Commission to increase health surveillance.</li> </ul>
<i>NAREI</i>	<ul style="list-style-type: none"> <li>- Provision of supplementary seeds or plants to farmers.</li> <li>- Impolder water for plantation crops such as sugar and rice to ensure moisture is provided.</li> <li>- Adjust cropping systems and introduce new varieties to water deficit condition using laboratory simulations.</li> </ul>
<i>NDIA</i>	<ul style="list-style-type: none"> <li>- Communicate directly with farmers to educate them on practicable measures related to water conservation and an efficient irrigation such as the sprinkler system.</li> <li>- Set up mobile pumps for drainage purposes and re-deploy to areas to provide water (water cannot be supplied by gravity given than the level will be lower than discharge point).</li> <li>- Test water quality for salinity; then communicate information to farmers (affected and may be affected).</li> </ul>

Source: Stakeholder Interviews

## 8.5 Description of Gaps

Gaps in the national system of response actions are as follows:

- i. Droughts are treated as crises requiring emergency interventions or short-term responses; as such, less emphasis is placed on drought preparedness to lessen risks and impacts.
- ii. Much of the weather information available is for short periods and best suited for monitoring meteorological drought. However, for a functional DEWS, seasonal forecasts are often presented as ‘tercile probabilities’, which refer to the probability that we can expect conditions will be above normal, normal, or below normal.
- iii. Provision of more precise data that will allow for the analysis, interpretation and dissemination of information on risks, and vulnerabilities of all local communities-whether coastal or interior.

<sup>58</sup> Perth is a large commercialized agricultural landholding in the MMA Scheme.

- iv. Linking Standardised Precipitation Index (SPI) with impact indicators to enable assessment of hydrological and socio-economic droughts.
- v. Absence of more reliable meteorological forecasts to promote more effective planning.
- vi. Spatial prioritization of droughts based on risk mapping that will help inform the allocation of resources as an element of response.
- vii. A more systematic approach to response by agencies to facilitate a comprehensive donor-supported programme. Integrating weather/climate information with data and information collected by other agencies allows for better monitoring of the occurrence of the other types of drought (as highlighted in Section 1 of this document) and their likely impact. This is useful for decision making on appropriate mitigation measures.

## **CHAPTER 9 ANALYSIS OF NATIONAL DROUGHT MITIGATION, PREPAREDNESS AND ADAPTATION MEASURES**

### **9.1 National Water Resources Monitoring and Impact Assessment**

Currently, monitoring of water resources is carried out primarily by four institutions, namely, GWI, GuySuCo, MMA-ADA and NDIA and includes the following measures:

- Maintaining optimum number of ground water wells, focusing on volume and distribution of available groundwater in the coastal plain, groundwater recharge mechanisms, and annual safe yield of groundwater, among other parameters;
- Daily monitoring of the Lamaha Conservancy level;
- Demand management in relation to consumption, using metering to ensure more efficient use of water as a conservation initiative;
- Ground water management in Regions 3 and 4, focusing on well fields; and
- Operationalisation of a Watershed Management Plan, for example, Dakoura Creek.

### **9.2 Development of New and Alternative Water Sources**

New and alternative water sources are critical to Guyana as a vital water supply in support of its water resilience.

#### **9.2.1 Rainwater/Freshwater Harvesting**

Rainwater harvesting is undoubtedly an effective water conservation strategy in urban and rural areas around the globe, decreasing unnecessary use of heavily treated drinking water for landscaping, toilet flushing, washing of vehicles and laundry washing. Rainwater can also serve for potable water uses by local communities in Guyana, if properly filtrated and treated.

Currently rainwater harvesting is widely practiced for domestic purposes, particularly along the Coast, where water is collected from roof tops into large, plastic storage tanks. Almost 15 % of the population depends on rainwater harvesting as their primary source of drinking water. In urban areas, some 16% of the population depends on rainwater collection as a drinking source, while the figure in rural areas is approximately 27% (Technology Adaptation Needs Assessment, Report 1, 2016).

Further, Guyana's agriculture sector is highly dependent on water availability; hence the importance of ensuring a continuous supply of fresh water. The GWI has promoted rainwater harvesting through affordable climate-resilient community-based water harvesting, storage and distribution systems that have been designed, built and rehabilitated in selected target areas. For instance, in 2017, the GOG developed water harvesting facilities to ensure that residents of villages in the North Rupununi could access regular and reliable water supply. Notably, the North and South Rupununi villages have



traditionally suffered from inadequate water supply for their crops and livestock during dry months of the year – which had a proven negative impact on the livelihood of thousands that occupy the region.

### 9.2.2 Elevated Storage Systems

Guyana has introduced the use of solar powered water systems to allow for the provision of water to hinterland communities for a period of 11 hours during non-pumping. This system is vital source of water storage and distribution.



**Figure 18: Elevate storage facility**

Elevate storage facility

Source: <https://www.kaiteurnewsonline.com/2019/03/21/timehri-north-hauraruni-residents-benefitting-from-improved-water-access/>



**Shade troughs to  
reduce heat stress.**

Source :

<https://www.facebook.com/pg/ClimateChangeGuyana/posts/>

### 9.2.3 Water Troughs

The use of water troughs to provide water for livestock during dry periods is also encouraged by the Hydrometeorological Service.

### 9.2.4 Greater Focus on Use of Surface Water

Guyana has embarked on the treatment of surface water to ensure communities have access to potable water supply for domestic and other uses; for example, the Dakoura Creek (West Bank of Linden) Wismar, Block 22, Blueberry Hill, Christiansburg. Dakoura Watershed Management Plan was also drafted to ensure protection of the valuable watershed area?



**Figure 19: Surface Water Treatment Plant at Dakoura Creek**

Source: <http://guyanachronicle.com/2018/04/04/efforts-to-preserve-dakoura-creek-bearing-fruit>

#### 9.2.5 Technology transfer

In 2018; the GoG signed a Technical Cooperation Agreement with Brazil (referred to as Technology to reduce the Effects of Droughts) to promote the transfer of Brazilian knowledge and experience related to mitigation of the effects of drought in the Region 9 to reduce the effects of drought.

#### 9.2.6 Public Education, Awareness and Outreach

Currently, there is no centrally coordinated public education and outreach programme, but rather, individual stakeholder agencies embark on activities with the view to empowering specific target groups to take appropriate actions to lessen their vulnerability to droughts. For example, the Hydrometeorological Service provides early warning information in the form of bulletins as presented in Figure 20 and Figure 21.



## HYDROMETEOROLOGICAL SERVICE OF GUYANA

### Farmers' Monthly Weather Bulletin

*To observe, archive and understand Guyana's weather and climate and provide meteorological, hydrological and oceanographic services in support of Guyana's national needs and international obligations.*

Issue # 86

May 2020

#### May-July 2020 Highlights

- The rainfall season has begun in both Northern and Southern Guyana.
- Rainfall is likely to be the usual or wetter for May through July over most parts of Guyana.
- Both night-time and daytime temperatures are expected to be at least as warm as usual.
- The frequency of sporadic downpours is likely to increase as the season progresses.
- The risk of flooding in some low-lying areas is likely to increase as the season progresses.
- Possibility for the increase of pests and diseases associated with wetter conditions.
- A gradual increase in surface wetness and soil moisture is anticipated, as the season progresses.
- The frequency of wet days and wet spells will increase as the season progresses.
- Dry spells of no concern in the May/July Season
- Neither El Niño or La Niña conditions are present.

Figure 20: Farmers' Monthly Weather Bulletin



## DROUGHT OUTLOOK

The forecast covering August 2019 to January 2020 (short-term) shows that there is no concern for drought. However, when looking at the period from December 2018 to November 2019 (long-term), there are some concerns for some surface water reservoirs until the end of November 2019. We advise all stakeholders to keep monitoring drought and look for our monthly updates.

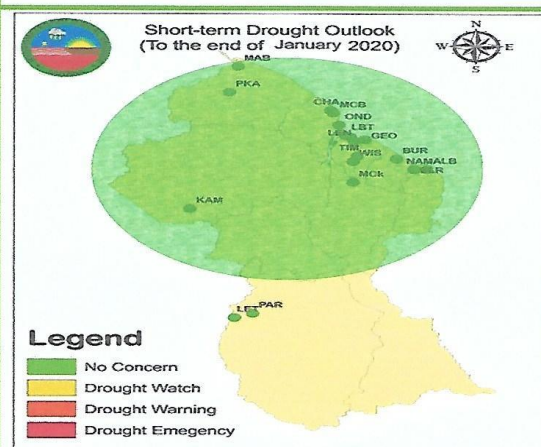


Fig.5: Short-term Drought Outlook by the end of January 2020 (Updated in October 2019-covering August 2019-January 2020)

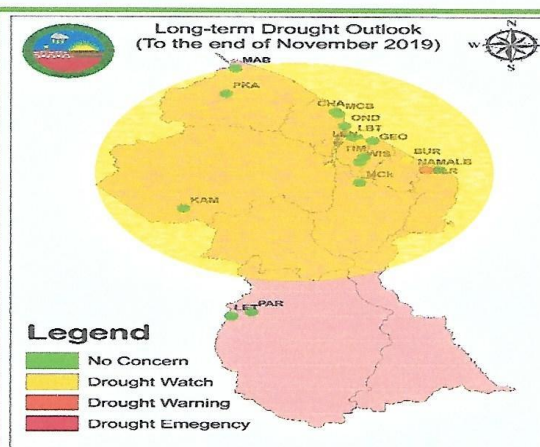


Fig.6: Long-term Drought Outlook by the end of November 2019 (Updated in October 2019 - covering December 2018 - November 2019)

## DROUGHT ALERT LEVELS

Alert Levels	Probabilities	Meaning
No Concern	< 33.3333	No Drought Concern
Drought Watch	33.3334-50	Drought is Possible
Drought Warning	50-83.3333	Drought Evolving
Drought Emergency	≥83.3334	Drought of Immediate Concern

## STATION ABBREVIATIONS

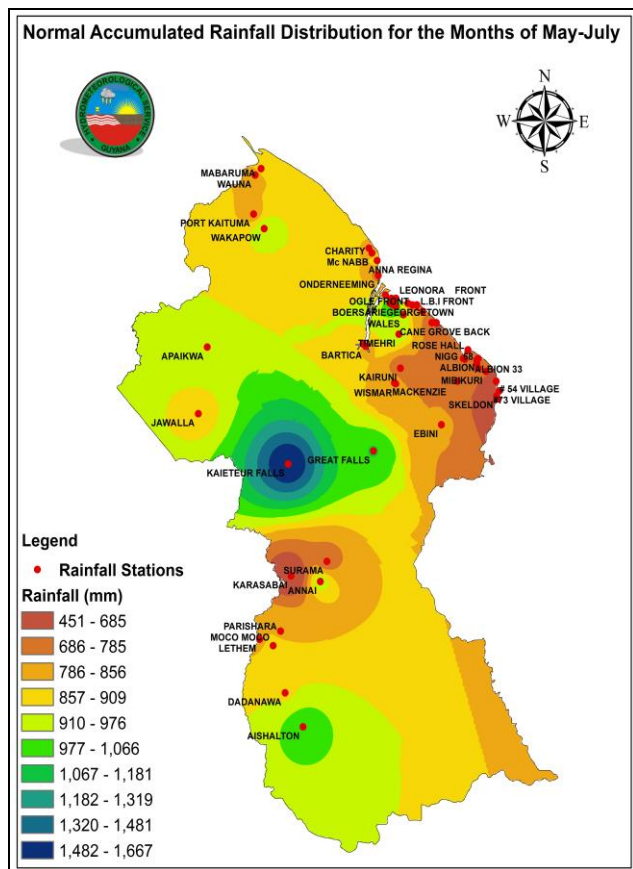
PKA-PORT KAITUMA	OND-ONDERNEEMING	DKF-DE KINDEREN FRONT	ENM-ENMORE	BLR-BLAIRMONT	KAM-KAMARANG	ANI-ANNAI
WAU-WAUNA	UIV-UITVLUGT	LEN-LEONORA	TIM-TIMHERI	NAM-NEW AMSTERDAM	LET-LETHEM	EBI-EBINI
ANR-ANNA REGINA	DKB-DE KINDEREN BACK	GEO-GEORGETOWN	CGB-CANE GROVE BACK	PAR-PARISHARA	KUM-KUMU	MCK-MCKENZIE
WAL-WALES	ROH-ROSE HALL	SKL-SKELDON	BUR-BURMA	MAB-MABARUMA	CHA-CHARITY	BAR-BARTICA
KAI-KAIETEUR	KAM-KAMRANG	-	-	-	-	-

This bulletin is prepared by the Hydrometeorological Service of Guyana. We welcome feedback, suggestions and comments on this bulletin. Correspondences should be directed to The Chief Hydrometeorological Officer at [garvin.cummings@gmail.com](mailto:garvin.cummings@gmail.com) and the Agronomist at [agrodonessa@yahoo.com](mailto:agrodonessa@yahoo.com). You may also visit our website at [www.hydromet.gov.gy](http://www.hydromet.gov.gy). Tele#: (592)-225-9303 and Fax#: (592)-226-1460.

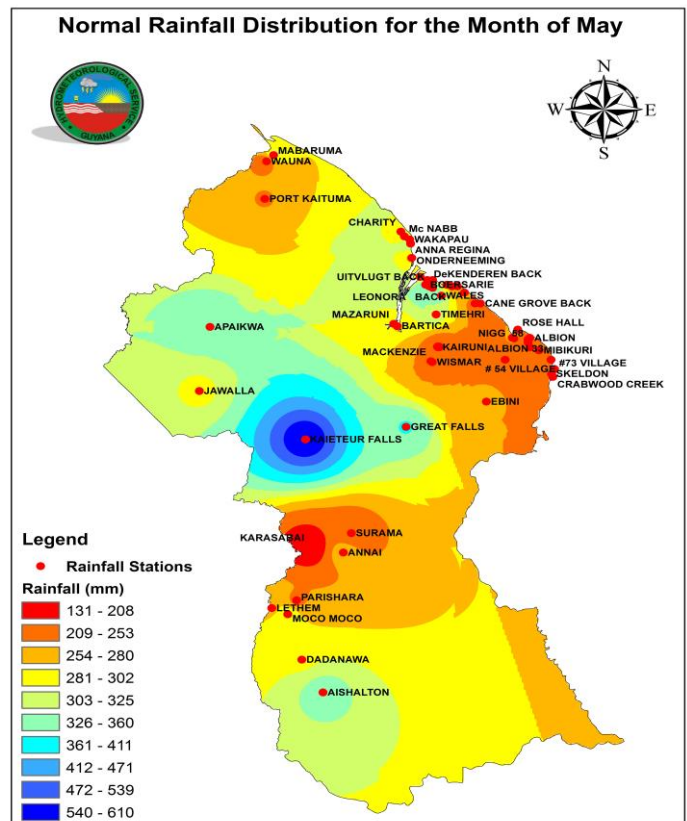
Figure 21 Forecast Outlook.

### Seasonal Rainfall Outlook (May-July 2020)

At least the usual rainfall conditions are expected for May through July. As the season progresses, it is expected that there will be a general increase in wet spells (consecutive days with rainfall). Increased periods of downpours are expected. In Figure 22, the normal accumulated rainfall totals of selected stations for the period May to July is represented. Figure 23 represents the normal rainfall of selected stations for the month of May.



**Figure 22** Normal Accumulation Rainfall Distribution for the months of May-July.



**Figure 23** Normal Rainfall Distribution for the month of May

The recommended coordinated public education and outreach programme should utilise both formal, and nonformal approaches to sensitise the public, primary and secondary school children, teachers, farmers, policy makers, media personnel and other stakeholders about the scientific understanding of drought, the potential impacts, and measures to build their resilience.

A typical public education and outreach programme should include the following elements:

- Public survey of level of knowledge, attitudes and practice in relation to drought preparedness, mitigation and response to provide baseline evidence.
- Design of tailored educational products (for example, such as pamphlets, posters, slides and videos) for specific target groups. Products should focus on the following:
  - o meteorological terminology (especially those used in forecasts and warnings)
  - o the range of public weather services provided and how to use them
  - o warnings and forecasts provided by the CDC
  - o drought preparedness and response
  - o drought mitigation

### 9.3 Participatory Integrated Climate Services of Agriculture (PICSA)

Farmers in Guyana have been benefiting from a Participatory Integrated Climate Services of Agriculture (PICSA), which basically aims to enable farmers to make informed decisions based on accurate, location specific, climate and weather information; locally relevant crop, livestock and livelihood options.

PICSA generally identifies the farming options for a particular location before presenting climate information to farmers in order to compare the climate information with the agricultural options for crops and livestock.

According to the Chief Hydrometeorological Officer, Dr. Garvin Cummings, *the PICSA approach is intended to train persons involved in the provision of agricultural services so that they can be carriers of climate information. With these officers equip with the ability to offer this additional information, Hydromet would not be required to create its own extension arm in terms of getting information to the farmers, but rather use the existing human resource infrastructure, train them so that when they go out into the fields they can be carriers of climate information*<sup>59</sup>.

Several stakeholder agencies participated in the first workshop<sup>60</sup> that was held on May 17, 2017: the Hydrometeorological Service, Department, National Agriculture Research and Extension Institute (NAREI), Guyana Livestock Development Authority (GLDA), The Guyana Marketing Corporation (GMC), Pesticide Board, The Guyana Rice Development Board (GRDB), The Guyana Sugar Corporation (GuySuCo), the Guyana School of Agriculture (GSA) and the North Rupununi District Development Board (NRDDB).

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<sup>59</sup> <https://demerarawaves.com/2017/05/16/guyanese-small-farmers-to-get-improved-climate-services/>

<sup>60</sup>The workshop was facilitated by the Ministry of Agriculture's Hydro-meteorological Department, with funding from the United States Agency for International Development's (USAID) Programme for Building Regional Climate Capacity in the Caribbean Programme (BRCCC Programme).

## 9.4 Other initiatives

The GWI promote public education on water conservation and preservation through an online Knowledge Centre that provides access to awareness kit, which is complemented by special World Water Day such as videos on Facebook (see [https://www.facebook.com/pg/guyanawaterinc/videos/?ref=page\\_internal](https://www.facebook.com/pg/guyanawaterinc/videos/?ref=page_internal)), essay and poster competitions for students as observed. For example, in 2016, children were asked to describe actions they and their families could take to save water at home, work and school, given the current prolonged dry season.

The OCC has an active website that provides information of climatic issues, including drought (<https://climatechange.gov.gy/en/index.php/about/facts/effects/10-climate-change-information>).

Additionally, outreach programmes on water management are executed by extension officers of NAREI. Such initiatives underscore the importance of the participation of farmers and farming communities in the management of drainage and irrigation systems, such as the Water Users' Associations in the management of water.

## 9.5 Legislation and Land Use Planning

Currently, there are several pieces of legislation related to the management of water resources in Guyana. Sub-sections 3.1 and 3.8 have highlighted aspects of two critical pieces of legislation (The Water and Sewerage Act, 2002, and the Environmental Protection Act (1996) that have implications for water resources management in Guyana. Others are described briefly below.

### 9.5.1 Statutory Water Rights in Guyana<sup>61</sup>

Water rights in Guyana are the property of the State (as successor to the Crown). The State then authorises use. According to Section 36 of the Constitution, the State will provide, protect and make rational use of its water resources, therefore the clear assumption that all water belongs to the State. Additionally, The State Lands Act (Cap 62:01) also presumes that the State is the owner of all water. Therefore, in keeping with this the Hydro-electric Power Act (Cap 56:03) mentions that, "Subject to any rights lawfully held, the property in and the sole right to the use of all State water powers are hereby declared to be vested in and shall remain the property of the State."

In the year 2002, as the water sector in Guyana underwent a major reformation the Government instituted a new legislation, the Water and Sewerage Act 2002 (the Act). The main role of this new Act was "to provide for the ownership, management, control, protection and conservation of water resources, the provision of safe water..." This Act is an important piece of legislation that provides detail

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<sup>61</sup> Janki, Melinda (n.d.) Customary Water Laws and Practices: GUYANA.

on how water is dealt with in Guyana. This is so since all water rights are determined by this Act and as a result a new regime for water use and management was established in Guyana.

#### 9.5.2 The East Demerara Water Conservancy Act

This Act (1935 and revised in 1998) established the East Demerara Water Conservancy for the purpose of making better provision for the supply of water in East Demerara. It also allows for the provision for the management of the conservancy and purposes connected to it. It is divided into ten parts. Below are extracts:

##### *Part 1: Establishment of the East Demerara Water Conservancy*

Part 1 of this Act deals with specifications such as the Constitution and meetings of the Board, Powers of the Chairman in an emergency, removal of a Commissioner from office, the power of the Board to employ officers and servants, transfer to Board of the property and obligations of its predecessors etc.

##### *Part 2: Management of the Conservancy*

Part 2 includes the general power of the Board, the Board to manage and control the conservancy and the Board to regulate traffic on and the supply of water from the conservancy.

##### *Part 3: Execution of Works by the Board*

This includes the Dam on the Demerara River to be constructed by the Board, when sanction is required before the work is undertaken and the supply of water by Conservancy to plantation not included in the first schedule.

##### *Part 9: Legal*

This includes general offences, penalty for opening koker or cutting dam, liability of proprietors for penalty, recovery of penalties etc.

##### *Part 10: Miscellaneous*

This includes by-laws and regulations and Protection of Commissioners acting under Act.



### 9.5.3 The Mining Amended Act (2005)

The Mining Amended Act (2005) was established in response to the growing number of environmental defaulters who contribute to contamination of rivers, creeks and other waterways affecting various life-forms. These laws encompass mercury use, mine reclamation, mine effluents, contingency planning, mine waste and tailings management.

The statutes set out by the legislation include compliance with a number of practices, failure of which may result in penalties. In particular, the law strictly prohibits: settling ponds less than 20 metres away from rivers, and seeks to ensure that mining sites are restored following the completion of mining activities. This includes (i) ensuring that mine sites are chemically hazard-free; (ii) reclamation plan must be completed prior to commencement of mining; (iii) site must be restored to visually reproductive state; and (iv) mine titles must be relinquished once all requirements are met.

Further, within the Mining (Amendment) Regulations 2005, Part XXVII Protected Areas, there are stipulations for mining activities near parks or protected areas. Nevertheless, two issues that require attention are the absence of any comments on operations for the extraction of water and the lack of institutional capacity to monitor miners' activities and enforce the relevant laws.

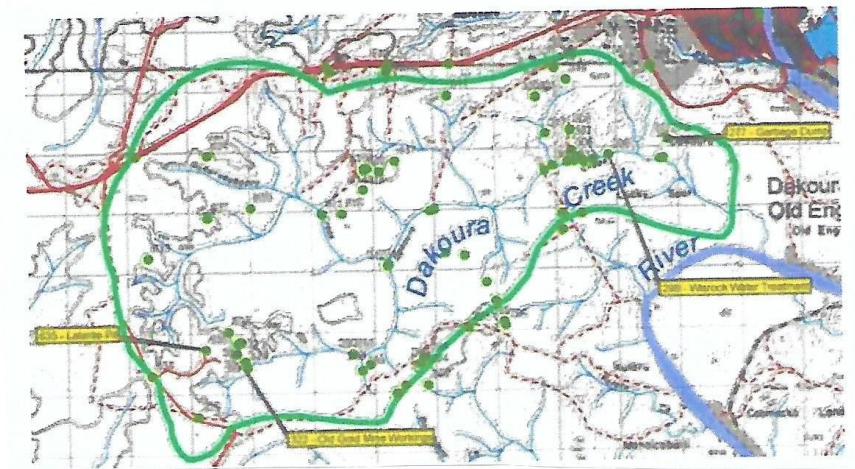
Inappropriate land use practices pose serious risks to water resources. In 2013, Guyana developed a National Land Use Plan, as a strategic framework to guide land development in Guyana. Additionally, many land use plans have been developed over the years for specific Regions and areas: initially for Regions 1, 2 and 10 and, more recently, by the GLSC for Region 6 in 2004, Region 9 (Sub-Region 1) in 2005, and for the Linden-Lethem-Road Corridor in 2006 and Soesdyke-Linden Highway in 2007. To date, only the land use plan for Region 6 has been approved. Moreover, the plans need objective targets and performance indicators if they are to be used as a dynamic tool for promoting good land management practice (Mainstreaming Sustainable Land Development and Management Project, 2017). Notably, the National Land Use Plan does not address drought; however, the Guyana Lands and Surveys Commission is currently undertaking several initiatives aimed at reviewing and updating the existing national plan to effectively address current land use and land management issues, including drought.

It is therefore prudent for Guyana to consider the promotion of certain types of land uses and development away from high risk/drought-prone areas which should be totally inaccessible to any form of housing development in future LUPs and iterations. LUPs should also be used to support watershed management and water body/river buffers.

## 9.6 Watershed Protection and Management

Guyana, through the GWI, has developed the Dakoura Watershed Management Plan for the Dakoura Creek<sup>62</sup> to ensure the sustainability of that water body as the primary water source for the west Sub-section of the Rehabilitated Linden Water System (RLWS) and to protect the health of the resident, among others. One of the primary goals of the RLWS is to maintain and improve water quality and supply with the following corresponding objectives:

- Control and minimize the input of toxic nutrients and compounds into water bodies to comply with current and future quality regulations
- Maintain water quality for healthy aquatic systems
- Maintain and restore nature stream flows for wetlands and other aquatic and riparian
- Maintain riparian buffers on major creeks along housing developments and farming areas.



**Figure 24:** Dakoura Creek Water Stream Network  
Source: Dakoura Creek Watershed Management Plan, 2018

## 9.7 Gaps/Issues

- The legislative environment related to the issue of land, land management and land tenure in Guyana consists of some archaic pieces of legislation and is very much fragmented. To overcome the negative impacts of this situation a comprehensive process legislative review/harmonization should be pursued urgently.

<sup>62</sup> The Dakoura Creek Watershed is one of five watersheds in Linden, all sub-basins of the Demerara River Watershed. It is approximately 13 kilometres long and 7 kilometres wide.

- The finalisation of a National Land Policy and an Integrated Water Resources Management that comprehensively address land tenure and water resources management, respectively, should also be given priority attention. As part of this policy initiative, the issue of data sharing for effective and efficient land administration in Guyana should be addressed. Generally, land administration capacity should be strengthened.
- Existing legislation hinders to some extent effective performance as it has evolved incrementally, on a sectoral and ad hoc basis, e.g. in relation to mining, forestry and the environment. Individual pieces of legislation address different environmental and land management issues, based on sectoral perspectives and in some cases new laws do not supersede previous regulations.
- Presently, there is no comprehensive policy on sustainable land development and management for public or private lands to promote appropriate land uses, good management practices, and integrated approaches. The absence of a clear implementation framework for land policy, legislation and lack of land planning and management guidelines is also a constraint to informed decision making with multiple stakeholders and promoting strategic investments in SLM as a basis for sustainable development in the short and long term.

## **CHAPTER 10 IMPLEMENTATION ACTIONS RECOMMENDED**

### **10.1 Priority Implementation Actions**

The design of a National Implementation Plan is vital to a well-coordinated and collaborative approach to drought management. It is envisaged that these recommendations will be given due consideration by the GoG and that adequate resources will be made available by means of the national budget and external donors grants and loans. The latter is critical to the successful implementation of the NDMAP.

In addition to national actions to be taken at various stages of a drought (as indicated on the UNCCD website and presented in Appendix IV of this document), Table 11 identifies priority actions that reflect a combination of literature review and recommendation made by stakeholders. In each case, related activities, output indicators, institutional responsibility, timelines and budget are provided.

**Table 11: Implementation Actions Recommended**

Implementation Actions recommended by Stakeholders	Activities	Indicator	Institution/s Assigned Responsibility and Partners	Timeline for Implementation
<b>Priority Implementation Actions (Pre-conditional)</b>				
Accelerate process to transform DRM Bill into law	<ul style="list-style-type: none"> <li>- Presentation of the DRM Bill to the House of Parliament</li> </ul>	DRM is enacted and promulgated	Ministry of the Presidency/Cabinet in collaboration with and the CDC	January – April 2021
National dialogue on drought to clearly define responsibility of each stakeholder agency with regard to drought monitoring	<ul style="list-style-type: none"> <li>- Conduct stakeholder mapping to ensure all relevant organization at the local, regional and national levels are duly considered</li> <li>- Plan and facilitate a one-day national workshop in Georgetown</li> <li>- Define and agree on critical issues and the role of each stakeholder</li> <li>- Review and revise (if necessary) Drought Committee membership</li> <li>- Activate the Drought Committee</li> </ul>	<ul style="list-style-type: none"> <li>- List of stakeholders with level of interest and influence is prepared</li> <li>- Report on national workshop is prepared and disseminated</li> <li>- Workshop participants lists</li> <li>- Role and responsibilities of stakeholders are identified and documented</li> <li>- Drought Committee membership is reviewed and revised and report prepared and submitted.</li> <li>- Meeting notes of Drought Committee</li> </ul>	CDC in collaboration with the GLSC and Hydromet	January – April 2021

Implementation Actions recommended by Stakeholders	Activities	Indicator	Institution/s Assigned Responsibility and Partners	Timeline for Implementation
<b>Drought Monitoring and Forecasting</b>				
Strengthen institutional capability of the CDC	<ul style="list-style-type: none"> <li>- Finalise Integrated Water Resource Management Plan (IWRMP)</li> <li>- Review and update draft IWRM Plan</li> <li>- Submit draft IWRM Plan for approval</li> <li>- Resuscitate National Water Council in accordance with the Water and Sewerage Act of 2002</li> </ul>	<ul style="list-style-type: none"> <li>- Documentation of approved IWRM Plan</li> <li>- Documentation on first National Water Council Meeting</li> </ul>	Ministry of Agriculture in collaboration with the Ministry of communities	January – April 2021
<p>Strengthen data infrastructure and management system</p> <p>Strengthen GIS capability in drought mitigation and response process</p>	<ul style="list-style-type: none"> <li>- Establish a national data sharing platform for droughts by integrated in the EIMMS that is currently developed by the Department of Environment as an activity under the Rio Mainstreaming Project</li> <li>- Establish clear operational direction of the existing Environmental Information Monitoring and Management System (EIMMS) and promote institutional buy-in by all sector stakeholders, using stakeholder consultative processes such as stakeholders’ meetings/forums</li> <li>- Develop specific protocols for data sharing and access data based on Geospatial Information Policy</li> <li>- Establish a GIS based drought information system as a component of the national platform for data sharing</li> </ul>	<ul style="list-style-type: none"> <li>- National data sharing platform is established and functional</li> <li>- Protocols developed for data sharing and access</li> <li>- Geospatial Information Policy implemented</li> <li>- Documentation on GIS based drought information system</li> </ul>	GLSC in collaboration with CDC, Hydromet and the Drought Committee	April –August 2021

Implementation Actions recommended by Stakeholders	Activities	Indicator	Institution/s Assigned Responsibility and Partners	Timeline for Implementation
Standardise data collection to promote and facilitate data driven decision making	<ul style="list-style-type: none"> <li>- Hire Consultant to develop standardized data collection methods for drought severity, gender differences and issues, vulnerability analysis etc. given Guyana's unique context</li> <li>- Facilitate training workshop for key stakeholders to ensure a comprehensive understanding of the agreed methodologies</li> <li>- Disseminate standardized data collection methods to all stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>- Documentation on Standardized data collection methods for drought severity, gender differences and issues, vulnerability analysis, etc.</li> <li>- Workshop report and pre- assessment and post assessment of workshop participants knowledge of the standardized methodologies</li> <li>- Workshop participants lists</li> </ul>	GLSC, in collaboration with CDC, NAREI, OCC and Hydromet	July –December 2021
Set up additional automatic weather stations	<ul style="list-style-type: none"> <li>- Conduct assessment of current state/diagnostic study of additional automatic weather stations and identify needs</li> <li>- Liaise with the CIMH and develop proposal for funding of additional weather stations</li> <li>- Conduct training workshop to empower stakeholders at the regional and local levels on use of data from automatic weather stations</li> </ul>	<ul style="list-style-type: none"> <li>- Report on diagnostic study</li> <li>- Number of additional automatic weather stations</li> <li>- Training workshop report</li> <li>- Workshop participants lists</li> </ul>	Hydromet in collaboration with the CIMH and the GGMC	September 2021 –June 2022

Implementation Actions recommended by Stakeholders	Activities	Indicator	Institution/s Assigned Responsibility and Partners	Timeline for Implementation
Increase drought monitoring (including drought impact) and dissemination of information	<ul style="list-style-type: none"> <li>- Develop other drought indices, bearing in mind the different types of droughts</li> <li>- Establish system for timely acquisition of near real-time climate and remotely sensed data</li> <li>- Standardise impact assessment methodology</li> </ul>	<ul style="list-style-type: none"> <li>- Documentation on other drought indices</li> <li>- Documentation on standardized impact assessment methodology</li> </ul>	Hydromet in collaboration with GuySuCo, NAREI and GLSC	January- June 2021
<b>Drought Impact Assessment</b>				
Enhance capacity of staff of the Meteorological Service	<ul style="list-style-type: none"> <li>- Conduct gap assessment of human capital of staff of Meteorological Service</li> <li>- Develop a Training Programme and seek funding for implementation of same</li> <li>- Develop Training Manual on Drought Assessment (severity etc.) for staff of Meteorological Service</li> </ul>	<ul style="list-style-type: none"> <li>- Gap assessment report</li> <li>- Training programme</li> <li>- Training Manual</li> </ul>	Hydromet	September 2020– March 2021
<b>Drought Risk and Vulnerability Assessment</b>				
Improve data collection (soil moisture, soil available water capacity, vegetation indicators, stream flow and reservoir levels) to enhance Climate Predictability Tool used to forecast droughts	<ul style="list-style-type: none"> <li>- Installation of 50 soil moisture sensors</li> <li>- Installation of 50 staff gauges in conservancies, rivers etc. to monitor water levels</li> </ul>	<ul style="list-style-type: none"> <li>- Number of soil moisture sensors installed</li> <li>- Number of staff gauges installed</li> </ul>	Hydromet in collaboration with NARIE and GUYSUCO	January- April 2021



Implementation Actions recommended by Stakeholders	Activities	Indicator	Institution/s Assigned Responsibility and Partners	Timeline for Implementation
Conduct drought risk and vulnerability assessments at regional level to determine geographic differences and appropriate responses	<ul style="list-style-type: none"> <li>- Use standardized vulnerability assessment methodology</li> <li>- Develop Plan of Action for assessment at sectoral and at regional levels</li> </ul>	<ul style="list-style-type: none"> <li>- Standardised vulnerability assessment methodology is disseminated</li> <li>- Plan of Action</li> </ul>	CDC, in collaboration with NARIE, GUYSUCO, GLSC and UG	January- June 2021
Identify and integrate gender-based differences and issues in the design and implementation in drought monitoring and early warning systems, Vulnerability and risk assessment, and Drought preparedness, mitigation and response	<ul style="list-style-type: none"> <li>- Hire a Consultant to facilitate a National Workshop to design an approach and identify opportunities for gender integration in the design and implementation in Drought monitoring and early warning systems, Vulnerability and risk assessment, and Drought preparedness, mitigation and response</li> <li>- Appendix II provides ideas for gender integration</li> </ul>	<ul style="list-style-type: none"> <li>- Documentation on workshop / workshop report</li> <li>- Participants register</li> </ul>	GLSC, in collaboration with CDC, NAREI, and Ministry of Social Protection	
Establish Regional Risk Management Team to operationalise the existing DRM Plan	<ul style="list-style-type: none"> <li>- Establish system of incentive for personnel to engage in work by liaising with the Ministry of the Presidency and the Ministry of Finance</li> <li>- Establish political modalities for decision-making (Regional Coordinators versus Regional Executive Officers) to facilitate coordinated operationalisation of Plan</li> <li>- Prepare regional budget and seek Parliamentary approval</li> </ul>	<ul style="list-style-type: none"> <li>- Documentation of established incentive system</li> <li>- Modalities for decision-making at regional level developed, approved and disseminated.</li> <li>- Approval of regional budget</li> </ul>	CDC and Ministry of Communities	September 2021 –June 2022

Implementation Actions recommended by Stakeholders	Activities	Indicator	Institution/s Assigned Responsibility and Partners	Timeline for Implementation
	<ul style="list-style-type: none"> <li>- Prepare recurrent training programme for regional personnel</li> <li>- Execute training programme</li> </ul>	<ul style="list-style-type: none"> <li>- Documentation on training programme</li> <li>- Workshop participants lists</li> </ul>		
<b>Drought Communication and Response</b>				
Institutionalise Drought Protocol	<ul style="list-style-type: none"> <li>- Identify relevant personnel (including from the GGMC) to represent agencies on the Drought Committee</li> <li>- Sensitize Committee members on the already established Drought Protocol</li> </ul>	<ul style="list-style-type: none"> <li>- Drought Committee is functional</li> <li>- Committee members have knowledge of the Drought Protocol</li> </ul>	CDC	January- June 2021
Implement effective DEWS	<ul style="list-style-type: none"> <li>- Review the existing DEWS Protocol</li> <li>- Sensitize members of the Drought Committee to the existing EWS</li> <li>- Implement the DEWS</li> </ul>	<ul style="list-style-type: none"> <li>- DEWS Protocol reviewed</li> <li>- Drought Committee sensitized to the existing DEWS</li> <li>- DEWS implemented</li> </ul>	GLSC, in collaboration with the CDC, Hydromet and NAREI	April –August 2021
Enhance drought communication, education and awareness to target specific social groups, including farmers	<ul style="list-style-type: none"> <li>- Hire Consultant to develop a comprehensive Drought Awareness and Education Programme, using a participatory approach</li> <li>- Launch the Drought Awareness and Education Programme</li> <li>- Conduct a series of drought awareness seminars, for example for Media</li> </ul>	<ul style="list-style-type: none"> <li>- Consultant hired and Drought Awareness and Education Programme developed and endorsed by stakeholders</li> <li>- Drought Awareness and Education Programme launched</li> <li>- Number of seminars and report of drought awareness seminars</li> </ul>	GLSC, in collaboration with CDC, MOA, NAREI, EPA, Hydromet and OCC	January- June 2021

Implementation Actions recommended by Stakeholders	Activities	Indicator	Institution/s Assigned Responsibility and Partners	Timeline for Implementation
	Professionals - Develop public awareness materials, optimizing the use of mass media/social media	- Prototypes of each public awareness material is submitted		
Strengthen forecasting capability and EWS technology	- Build staff capacity to strengthen forecasting capability	- Training workshop on other drought monitoring and forecasting techniques	Hydromet	April –August 2021
Strengthen institutional integration of EWS Approach Improve EWS; more reliable forecast through better technology	- Collaborate with regional and international organisation to build capacity	- Stakeholders have access to more reliable forecast	Hydromet in collaboration with all the agriculture agencies	April –August 2021
<b>Drought Mitigation and Preparedness</b>				
Integrate drought initiatives in all climate dependent/ related sectors to avoid crisis management	- Plan and conduct drought management workshop that involves the Permanent Secretaries of climate dependent/ related sectors on Day 1  - Explore opportunities for integration of drought initiatives in sector programmes  - Develop and agree on Plan of Action and Reporting Modalities	- Documentation on Plan of Action and Reporting Modalities  - Workshop participants lists	GLSC in collaboration with the CDC, NAREI, Hydromet and OCC	July –December 2021
Promote greater institutional collaboration, including the private sector	- Review membership of the Drought Committee  - Review and revise communication networks between stakeholders  - Institutionalize meeting and modalities of reporting	- Feedback from stakeholder organizations	CDC	September- December 2020

Implementation Actions recommended by Stakeholders	Activities	Indicator	Institution/s Assigned Responsibility and Partners	Timeline for Implementation
Strengthen drought preparedness nationally	<ul style="list-style-type: none"> <li>- Convert more of gravity or surface irrigation schemes to pressured irrigation systems such as drip or sprinkler systems</li> <li>- Improving the efficiency of surface irrigation systems</li> <li>- Establish system of water allocation during droughts</li> <li>- Promote the use of alternative sources of water through awareness seminars.</li> <li>- Reactivate the National Water Council to finalise the draft Integrated Water Management Policy and Road Map</li> </ul>	<ul style="list-style-type: none"> <li>- Number of pressure irrigations systems</li> <li>- Documentation on system of water allocation during droughts</li> <li>- Awareness materials on the use of alternative sources of water</li> <li>- Documentation on meeting of National Water Council</li> <li>- Finalised Integrated Water Management Policy and Road Map</li> </ul>	<p>GWl in collaboration with GuySuCo, NAREI NDIA, MMA-ADA, and GRDB</p>	September 2021 –June 2022
Conduct curriculum review and update same to educate students on drought responses	<ul style="list-style-type: none"> <li>- Hire National Consultant to conduct a curriculum audit of primary, secondary and tertiary education al institutions and to identify gaps and propose interventions</li> <li>- Hire National Consultant to prepare Digital Toolkit for integration of drought issues in curricula</li> <li>- Plan, organize and facilitate training workshops at national and regional levels to education teachers/lecturers on integration of drought issues into existing curricula and to develop prototypes of various lessons/lectures</li> </ul>	<ul style="list-style-type: none"> <li>- Report on curriculum audit, gap analysis and proposed interventions</li> <li>- Toolkit for integration of drought issues in curricula</li> <li>- Reports on workshops and prototype lessons/lectures</li> </ul>	<p>GLSC, CDC, OCC, Hydromet and Ministry of Education</p>	September 2021 –June 2022

Implementation Actions recommended by Stakeholders	Activities	Indicator	Institution/s Assigned Responsibility and Partners	Timeline for Implementation
Strengthen extension system	<ul style="list-style-type: none"> <li>- Introduce/Establish a Farmer Field School to help farmers learn about droughts and improve their production system</li> </ul>	<ul style="list-style-type: none"> <li>- Documentation on Farmer Field School<sup>63</sup></li> </ul>	MOA-NAREI and GLDA	
Others				
Increase access to financial resources to establish disaster risk funds	<ul style="list-style-type: none"> <li>- Hire Consultant to develop Action Plan for resource mobilization to ensure financial resources are available for implementation of this NDMAP</li> </ul>	Documentation on Plan of Action	GLSC	September 2020
Review NDMAP every five years	<ul style="list-style-type: none"> <li>- Hire Workshop Facilitator</li> <li>- Organize Drought Committee and other Stakeholders Workshop</li> <li>- Develop scope and programme</li> <li>- Conduct workshop</li> <li>- Revise NDMAP</li> </ul>	Workshop report  Revised NDMAP	GLSC in collaboration with Hydromet and CDC	

<sup>63</sup> The FFS approach is an innovative, participatory and interactive learning approach that emphasizes problem solving and discovery based learning. FFS aims to build farmers' capacity to analyse their production systems, identify problems, test possible solutions, and eventually encourage the participants to adopt the practices most suitable to their farming systems (FAO, 2003 c). FFS can also provide an opportunity for farmers to practice and test/evaluate sustainable land use technologies, and introduce new technologies through comparing their conventional technologies developed with their own tradition and culture. See <http://www.fao.org/3/i2561e/i2561e01.pdf>.

## 10.2 Implementation of the National Drought Management and Adaptation Plan

Successful implementation of the NDMAP is dependent largely on a fully functional and well-resourced Drought Committee that is given the legal mandate to carry out its roles and responsibilities accordingly. It is envisaged that each activity that is aligned to a specific objective will be fully developed by the Drought Committee to ensure the necessary details and a corresponding budget are provided. Importantly, each activity has a lead agency that must work in partnership with other stakeholders to operationalise the Plan.

Financial support for the implementation of the NDMAP is paramount; as such, the GL & SC in its role as the UNCCD focal point will coordinate efforts to provide adequate financial resources to support the implementation of the NDMAP. Such efforts will include budget preparation and presentation to the Ministry of Finance, as well as partnering with the focal points for the UNCBD and the UNFCCC on cross-cutting programmes and projects that have international donor support.

## 10.3 Future Updates and Revision of the National Drought Management and Adaptation Plan

The NDMAP will be reviewed and revised every five years through a national process that will be led by the UNCCD Focal Point Agency (GLSC) and will involve the Drought Committee.

Updates and revisions will be informed by science-based studies that provide the contextual framework to assure the relevance and effectiveness of each intervention. The revised and updated version will then be shared with stakeholders and specific public awareness and sensitization programmes for the Guyanese public will be developed and implemented.

## 10.4 Monitoring of the Implementation of the National Drought Management and Adaptation Plan

Monitoring of the implementation of the NDMAP is essential to ensure the stated objectives and expected results are being achieved in an efficient manner. Moreover, periodic feedback on the implementation of the NDMAP will allow the Drought Committee to keep track of the specified timelines, identify potential problems and take the necessary corrective actions in a timely manner; as such, monitoring of the Plan will be done on a quarterly basis.

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## APPENDICES

### 12.1 APPENDIX I

LIST OF STAKEHOLDER ORGANISATIONS THAT PARTICIPATED IN INTERVIEWS				
	Stakeholder Agency	Name of Interviewee	Position	Date of Interview
1.	Civil Defence Commission	Mr. Salim October Mr. Latchman Persaud	Senior Response Officer Operations Officer	20-11-2019
2.	EPA	Mr. Collis Primo	Senior Environmental Officer	20-12-2019
3.	GGMC	Mr. Newell Dennison Mr. Godfrey Scott	Commissioner Senior Environmental Officer	08-01-2020
4.	GRDB	Mr. Nizam Hassan	General Manager	22-11-2019
5.	GSLC (Focal Point Agency)	Ms. Andrea Mohammed Mr. Roland Austin Mr. Chetwynd Osborne Mr. Asib Mohamed	Head, Land Use Policy, Planning and Projects Division Senior Land Use Planner Policy Analyst Senior Projects Officer	22-11-2019
6.	Guyana Fire Service	Mr. Gregory Wickham	Chief Fire Officer	18-12-2019
7.	Guyana Livestock Development Authority	Mr. Richard Nigel Cumberbatch Mr. Michael Welch Ms. Terresa Jacobs Ms. Colleen Bascom Dr. Colbert Bowen	Chief Executive Director Climate Officer Livestock Officer Head of Animal Production Head of Animal Health	8-01-2020
8.	Guyana Red Cross Society	Ms. Dorothy Fraser	Secretary General	22-11-2019

9.	GuySuCo	Dr. Harold Davis Jr. Mr. Ashley Adams	CEO Manager, Agronomy Research	19-12-2019
10.	GWJ	Dr. Richard Van West Charles  Mr. Aubrey Roberts  Ms. Denise Woolford	Managing Director  Executive Director, Design of Infrastructure  Manager, Water Resources and Climate	18-12-2019
11.	Hydrometeorological Service	Ms. Donessa David	Head of Meteorology	22-11- 2019
12.	Ministry of Public Health	Ms. Abigail Liverpool	Principal Environmental Health Officer	19-12-2019
13.	MMA-ADA	Mr. Mahendranauth Ramjit	Manager for Drainage and Irrigation Services	06-01-2020
14.	NAREI	Mr. David Fredericks	Deputy CEO	06-01-2020
15.	NDIA	Ms. Crystal Conway  Mr. Timothy Innis	GIS Engineer  Senior Section Engineer	21-11-2019
16.	OCC	Mrs. Janelle Christian  Mr. Esan Hamer	Head  Climatologist	18-12-2019
17.	PAHO/WHO	Dr. Zoila Fletcher-Payton  Ms. Tameca Noel	Consultant, Health Surveillance and Disease Prevention and Control  Consultant, Disaster Preparedness & Response and Smart Hospitals Initiative	18-12-2019
18.	UNDP	Mr. Jairo Valverde Bermudez  Ms. Vedyawattie Looknauth	Resident Representative  Programme Analyst	19-12-2019

		Ms. Tashie Browne	Programme Associate	
19.	UN FAO	Dr. Gillian Smith	Country Representative	20-11-2019
20.	REDD Secretariat, GFC	Ms. Uma Madray	Project Officer	27-01-2020

**The following ten actions are key to ensuring a gender-responsive approach throughout integrated drought risk management planning process.<sup>64</sup>**

1. Incorporate gender perspectives into drought risk-management efforts at national, local and community levels, including in policies, strategies, action plans and programmes
2. Increase the participation and representation of women at all levels of the decision-making process
3. Analyse drought and climate data through a gender lens and collect sex-disaggregated data
4. Ensure that women are being prominently engaged as agents of change at all levels of drought preparedness, including early warning systems, education, communication, information and networking opportunities
5. Consider the reallocation of resources to achieve gender equality outcomes from the actions planned
6. Take steps to reduce the negative impacts of drought on women, particularly in relation to their critical roles in rural areas in the provision of water, food and energy by offering support, health services, information and technology.
7. Include traditional knowledge and perspectives of women in the analysis and evaluation of the characteristics of drought risk-coping strategies and solutions
8. Build the capacity of national and local women's groups and provide an adequate platform that presents their needs and views
9. Consider the level of women's access to technology, finances, health care, support services and security during drought
10. Include gender-specific indicators and data disaggregated by sex and age to monitor and track progress on gender equality target

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<sup>64</sup>Adapted from UNEP (2012): Gender and adaptation, Capacity development series Africa, p. 23.

### 12.3 APPENDIX III

Several regional organizations<sup>65</sup> can assist Guyana with drought monitoring and forecasting, including:

- Caribbean Disaster Emergency Management Agency - CDEMA, ([www.cdema.org/](http://www.cdema.org/));
- Caribbean Meteorological Organization provides training for the Region's weather observers and technicians, weather forecasters, specialists in hydrology, agro meteorology and other related disciplines. ([www.cmo.org.tt/](http://www.cmo.org.tt/));
- The main institution in Brazil forecasting droughts and floods for all South America with an excellent record is the INPE - National Institute For Space Research ([www.inpe.br/ingles/](http://www.inpe.br/ingles/)). Brazil also gathers hydrological and meteorological data from rivers basins close to the border that might be suitable for enhancing Droughts Early Warning Systems (DEWS) in Guyana, but no Memorandum of Understanding has been established in this regard.
- Centre for Weather Forecasting and Climate Research – CPTEC is a branch of INPE dedicated to weather forecast, including droughts (<http://www.cptec.inpe.br/home/in>). CPTEC is willing to help Guyana;
- The Caribbean Climate Outlook Forum ([www.cimh.edu.bb/pdf/caricofmamija.pdf](http://www.cimh.edu.bb/pdf/caricofmamija.pdf));
- The U.S. Drought Monitor – USDM<sup>66</sup> ([droughtmonitor.unl.edu/](http://droughtmonitor.unl.edu/));
- The National Integrated Drought Information System ([www.drought.gov/](http://www.drought.gov/));
- NOAA - National Oceanic and Atmospheric Administration (Weather) (<http://www.noaa.gov/wx.html>);
- Climate Prediction Centre – NOAA ([www.cpc.ncep.noaa.gov/products/predictions/90day/](http://www.cpc.ncep.noaa.gov/products/predictions/90day/));
- National Drought Mitigation Centre (<http://drought.unl.edu/>);
- Caribbean Drought and Precipitation Monitoring Network (CDPMN) (<http://www.cimh.edu.bb/cami/files/cdpmn.pdf>);<sup>67</sup>
- Caribbean Centre for Climate and Environmental Simulations – CCCES (<http://www.cimh.edu.bb/?p=ccces>); and
- Caribbean Agricultural Research & Development Institute ([www.cardi.org/](http://www.cardi.org/)).

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<sup>65</sup> For more information see Guyana Drought Early Warning System Protocol (2015: 18).

<sup>66</sup> USDM relies on several key indicators and indices such as the Palmer Drought Severity Index (PDSI), the Standardized Precipitation Index, stream flow, vegetation health, soil moisture and impacts, as well as Keetch-Byram Drought Index, reservoir levels, Surface Water Supply Index, river basin snow water equivalent, and pasture and range conditions.

<sup>67</sup> Guyana is a member of the (CDPMN) which was established as part of the Caribbean Water Initiative (CARIWIN) Project. Information is shared with the National Drainage and Irrigation Authority, Civil Defence Commission, all of the agencies that reports to Ministry of Agriculture, extensions officers.

## 12.4 APPENDIX IV

### Required actions at various phases of drought: a template

Phases	Indicators	Actions to be considered
Drought advisory	<ul style="list-style-type: none"> <li>- Abnormally dry</li> <li>- Stream flow, wells, reservoir and groundwater levels start to drop</li> <li>- Identified high risk stakeholders notice reduction in access to water</li> </ul>	<ul style="list-style-type: none"> <li>- Monitor physical factors, including water supply to high risk stakeholders regularly, conduct a targeted public information campaign</li> <li>- Drought task force monitors situation on monthly basis, discusses trends with meteorology services and other involved parties</li> </ul>
Drought watch/alert	<ul style="list-style-type: none"> <li>- PDI -1.0 to-2.0 - Stream flow, wells, reservoir and groundwater levels are below normal</li> <li>- Damage to crops, pastures</li> </ul>	<ul style="list-style-type: none"> <li>- Closer monitoring of indicators of persisting or rapidly worsening drought</li> <li>- Assess the need for a formal risk assessment committee (RAC) activation</li> <li>- Restrict non-essential water uses, ensuring that priority is given to personal and domestic rather than business use</li> <li>- Official state of drought not yet declared</li> </ul>
Drought warning	<ul style="list-style-type: none"> <li>- PDI -2.0 to-4.0</li> <li>- Stream flow, wells, reservoir and ground water levels continue to decline</li> <li>- Water shortages become common</li> </ul>	<ul style="list-style-type: none"> <li>- Implement stringent water conservation measures</li> <li>- Enact mandatory restrictions</li> <li>- The drought task force (DC) and monitoring committee (MC) are activated</li> <li>- Potential drought emergency declared</li> </ul>
Drought emergency	<ul style="list-style-type: none"> <li>- PDI -2.0 to -4.0</li> <li>- Major crop/pasture losses; widespread water shortages</li> </ul>	<ul style="list-style-type: none"> <li>- Begin mandatory water allocation</li> <li>- Allow max per capita use of water - Plans for provision or re-allocation of water to ensure that min volume access (e.g. 50 l pp/d) is maintained to everyone at an affordable price, including high risk stakeholders</li> <li>- Drought emergency is declared by proclamation of the head of state</li> </ul>



Coming out of drought	<ul style="list-style-type: none"> <li>- Return to normal conditions</li> <li>- Some lingering water deficits; pastures or crops not fully recovered</li> </ul>	<ul style="list-style-type: none"> <li>- Long-term recovery operations continue</li> <li>- Drought Committee issues a final report and is deactivated Resume normal monitoring</li> </ul>
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Source: <https://knowledge.unccd.int/sites/default/files/2019-04/Model%20Drought%20Plan.pdf>

## 12.5 Appendix V

### ***Adaptive capacity***

The ability of a system to evolve in order to accommodate environmental hazards or policy change and to expand the range of variability with which it can cope (Adger 2006). Can also include the ability of the system to take advantage of opportunities, or to cope with the consequences (Füssel and Klein 2006).

### ***Agricultural drought***

Agricultural drought is a deficit of soil moisture (mostly in the root zone), reducing the supply of moisture to vegetation and oftentimes leading to crop failure (Van Loon 2015).

### ***Capacity***

A combination of all the strengths and resources available within a community, society or organization that can reduce the level of risk, or the effects of a disaster. Capacity may include physical, institutional, social or economic means as well as skilled personal or collective attributes such as leadership and management. Capacity may also be described as capability.

([https://www.preventionweb.net/files/7817\\_7819isdrterminology11.pdf](https://www.preventionweb.net/files/7817_7819isdrterminology11.pdf))

### ***Disaster***

A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources. A disaster is a function of the risk process. It results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk.

([https://www.preventionweb.net/files/7817\\_7819isdrterminology11.pdf](https://www.preventionweb.net/files/7817_7819isdrterminology11.pdf))

### ***Disaster risk management***

The systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impacts of natural hazards and related environmental and technological disasters. This comprises all forms of activities, including structural and non-structural measures to avoid (prevention) or to limit (mitigation and preparedness) adverse effects of hazards.

([https://www.preventionweb.net/files/7817\\_7819isdrterminology11.pdf](https://www.preventionweb.net/files/7817_7819isdrterminology11.pdf))

### ***Drought vulnerability***

The conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards (UNISDR 2015)

The degree to which a system is susceptible to, or unable to cope with, adverse effects of drought. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity (IPCC 2014).

### ***Early warning***

The provision of timely and effective information, through identified institutions, that allows individuals exposed to a hazard to take action to avoid or reduce their risk and prepare for effective response. Early warning systems include a chain of concerns, namely: understanding and mapping the hazard; monitoring and forecasting impending events; processing and disseminating understandable warnings to political authorities and the population, and undertaking appropriate and timely actions in response to the warnings. ([https://www.preventionweb.net/files/7817\\_7819isdrterminology11.pdf](https://www.preventionweb.net/files/7817_7819isdrterminology11.pdf))

### ***Exposure***

The nature and degree to which a system experiences environmental or socio-political stress (Adger 2006). The characteristics of these stresses include their magnitude, frequency, duration and areal extent of the hazard. ([https://www.preventionweb.net/files/7817\\_7819isdrterminology11.pdf](https://www.preventionweb.net/files/7817_7819isdrterminology11.pdf))

### ***El Niño-southern oscillation (ENSO)***

A complex interaction of the tropical Pacific Ocean and the global atmosphere that results in irregularly occurring episodes of changed ocean and weather patterns in many parts of the world, often with significant impacts, such as altered marine habitats, rainfall changes, floods, droughts, and changes in storm patterns. The El Niño part of ENSO refers to the well-above-average ocean temperatures along the coasts of Ecuador, Peru and northern Chile and across the eastern equatorial Pacific Ocean, while the Southern Oscillation refers to the associated global patterns of changed atmospheric pressure and rainfall. La Niña is approximately the opposite condition to El Niño. Each El Niño or La Niña episode usually lasts for several seasons.

### ***Geographic information systems (GIS)***

Analysis that combine relational databases with spatial interpretation and outputs often in form of maps. A more elaborate definition is that of computer programmes for capturing, storing, checking, integrating, analysing and displaying data about the earth that is spatially referenced. Geographical information systems are increasingly being utilised for hazard and vulnerability mapping and analysis, as well as for the application of disaster risk management measures.

([https://www.preventionweb.net/files/7817\\_7819isdrterminology11.pdf](https://www.preventionweb.net/files/7817_7819isdrterminology11.pdf))

## ***Hazard***

A potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological and biological) or induced by human processes (environmental degradation and technological hazards). Hazards can be single, sequential or combined in their origin and effects. Each hazard is characterised by its location, intensity, frequency and probability. ([https://www.preventionweb.net/files/7817\\_7819isdrterminology11.pdf](https://www.preventionweb.net/files/7817_7819isdrterminology11.pdf))

## ***Hydrological drought***

Hydrological drought is a lack of water in the hydrological system, manifesting itself in abnormally low stream flow in rivers and abnormally low levels in lakes, reservoirs, and groundwater (Van Loon 2015).

## ***Meteorological drought***

Meteorological drought is a precipitation deficiency, possibly combined with increased potential evapotranspiration, extending over a large area and spanning an extensive period of time (Van Loon 2015).

## ***Mitigation***

Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards.

([https://www.preventionweb.net/files/7817\\_7819isdrterminology11.pdf](https://www.preventionweb.net/files/7817_7819isdrterminology11.pdf))

## ***Preparedness***

Activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations.

([https://www.preventionweb.net/files/7817\\_7819isdrterminology11.pdf](https://www.preventionweb.net/files/7817_7819isdrterminology11.pdf))

## ***Resilience / resilient***

The capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures. ([https://www.preventionweb.net/files/7817\\_7819isdrterminology11.pdf](https://www.preventionweb.net/files/7817_7819isdrterminology11.pdf))

## ***Risk***

The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions.

([https://www.preventionweb.net/files/7817\\_7819isdrterminology11.pdf](https://www.preventionweb.net/files/7817_7819isdrterminology11.pdf))

## ***Sensitivity***

The degree to which a system is modified or affected by perturbations (Adger 2006), such as a change in climatic conditions brought about by the onset of drought.

## ***Socio-economic drought***

Socio-economic drought occurs when the demand for an economic good exceeds supply because of a weather-related shortfall in water supply (Wilhite and Glantz 1985). Indicators and indices for monitoring and early warning of socio-economic drought appearance are relatively uncommon. ([https://www.preventionweb.net/files/7817\\_7819isdrterminology11.pdf](https://www.preventionweb.net/files/7817_7819isdrterminology11.pdf))

## ***Standardised Precipitation Index (SPI)***

The Standardized Precipitation Index (SPI) is the most commonly used indicator worldwide for detecting and characterizing meteorological droughts. The SPI indicator, which was developed by McKee et al. (1993), and described in detail by Edwards and McKee (1997), measures precipitation anomalies at a given location, based on a comparison of observed total precipitation amounts for an accumulation period of interest (e.g. 1, 3, 12, 48 months), with the long-term historic rainfall record for that period. The historic record is fitted to a probability distribution (the “gamma” distribution), which is then transformed into a normal distribution such that the mean SPI value for that location and period is zero. For any given region, increasingly severe rainfall deficits (i.e., meteorological droughts) are indicated as SPI decreases below  $-1.0$ , while increasingly severe excess rainfall are indicated as SPI increases above  $1.0$ . Because SPI values are in units of standard deviation from the long-term mean, the indicator can be used to compare precipitation anomalies for any geographic location and for any number of time-scales. ([https://edo.jrc.ec.europa.eu/documents/factsheets/factsheet\\_spi.pdf](https://edo.jrc.ec.europa.eu/documents/factsheets/factsheet_spi.pdf); World Meteorological Organization. 2012.)

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