

CARIBBEAN INSTITUTE FOR METEOROLOGY AND HYDROLOGY  
CARIBBEAN REGIONAL CLIMATE CENTRE

Climate Services for the Caribbean Society  
Policy Brief Series  
<https://rcc.cimh.edu.bb>

Brief for Policy-makers within the Agriculture Sector #1: May 2020

Climate Services and Agriculture: Exploring the Policy Options

Recommendations from the Caribbean Pilot Programme for Climate Resilience (PPCR)  
(<https://caribppcr.org.jm>)

This Policy Brief:

- Summarises the major implications of climate on agricultural productivity;
- Discusses major issues towards building adaptation and resilience to the impacts of extreme weather and climate events on the agricultural sector of the Caribbean; and
- Highlights the suite of products, packages and services produced by the Caribbean Regional Climate Centre (RCC) that can assist agricultural policy makers in their decision making and planning.

Key Issue(s)	Recommendation(s)
Climate events continue to result in significant damage and loss for Caribbean agriculture.	Sector access to and application of freely available operational climate information products developed by the Caribbean RCC in some instances, in association with its national and regional agriculture partners in support of agricultural decision making is critical.
Sensitisation of farmers and rural community groups, to the importance of weather and climate information in farming and	Forums for farmers, extension officers, and other agriculturists to interface with NMHSs and researchers (where possible) learning more about products, while at the same time providing necessary feedback for improving products and establishing new, relevant products. Radio and television programmes and newspaper articles can also be used to sensitise farmers and raise awareness.
An avenue to provide feedback on the relevance and usefulness of available products, as well as to recommend additional information products.	
Appropriate means of dissemination of weather and climate information that ensure that farmers are reached, and are presented in a language and format that farmers can understand.	Pursue a robust Strategy for Communication with the assistance of communication specialists, at the national and regional levels, ensuring efficient and effective dissemination of information. The REACH project may offer some insight into the approach necessary for the Strategy.
Capacity building In a changing climate, it is imperative that Agricultural Extension Officers be better equipped to advise farmers on issues related to weather, climate and climate change.	Support specialised training for Agricultural Extension Officers and other agriculturists in the interpretation and application of weather and climate information, and agrometeorology in general. This may include in-class courses and the expansion of the PICSA approach across the Caribbean.

Key Issue(s)	Recommendation(s)
<p>There is a paucity of data, including biological, agronomic, soil and hydrometeorological, needed for the development and application of statistical, crop, irrigation and pests and diseases models. Information from such models is critical to decision and policy making.</p> <p>Research support from universities and regional research institutions that helps to satisfy the information needs of the national agricultural institutions and farmers</p>	<p>Financial and human resources made available for adequate, well maintained observation networks of higher spatial density that include Automatic Weather Stations. Particular emphasis should be placed on enhancing the quality and detail of biological information.</p> <p>Support a regional applied research agenda involving national and regional research institutions that catalyses the production of tailored information for the agriculture sector.</p>

## Agriculture in the Caribbean

Agriculture contributes to the development of an economy in several ways, from providing food and raw material to non-agricultural sectors of the economy to providing employment to a vast army of uneducated and unskilled labour to earning foreign exchange through the export of agricultural products. Within the Caribbean, the contribution of the agricultural sector to total employment and GDP varies from country to country. For example, the agricultural sector contributes 18.25% and 15.4% to the total employment and GDP, respectively, of Guyana. This is contribution is even greater for the economy of Haiti, which is far more agrarian, being 49.7% and 22.1%, respectively. In a more diverse economy, such as Trinidad and Tobago, the contribution of the agricultural sector to total employment and GDP is less, being 3.14% and 1.03% respectively (refer to Figure 1).

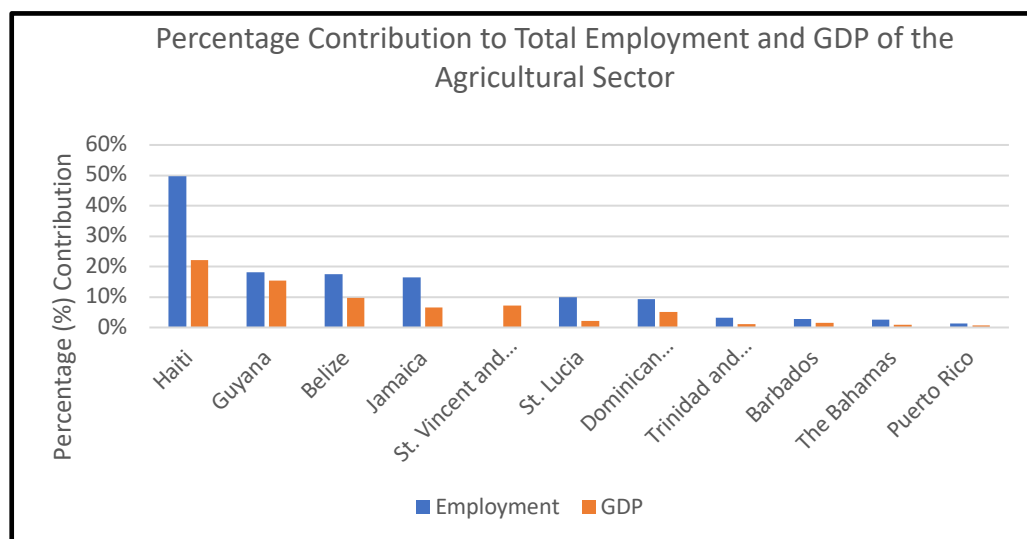


Figure 1: Clustered Column Graph showing the Percentage Contribution of the Agricultural Sector to the Total Employment and the GDP within Caribbean Countries. Data Sources:  
■ World Bank, 2019: (<https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS>)  
■ Index Mundi, 2017 (<https://www.indexmundi.com>)

## **Climate and Extreme Weather Impacts on Agriculture**

Climate variability within the region often results in extreme events; such as droughts, floods, tropical cyclones, wet spells, dry spells and, to a lesser degree heat spells. These events often result in significant damage and loss for Caribbean agriculture:

- Droughts – In 2019, Belize suffered an estimated USD 25 million in crop losses due to drought (The San Pedro Sun, 2019) and, similarly, in the Jamaica an estimated 5,600 farmers were affected with losses of approximately 500 hectares of crops (The Jamaica Observer, 2019).
- Floods – during 2018, approximately 75% of local farmers in Trinidad were severely affected through the loss of crops and livestock by floods. In 2012, the parish of St. Mary in Jamaica suffered about USD 1.67 million in overall damages, occurring on 415 hectares of farmland and affecting about 5,500 farmers that were clearly related to flooding and land slippage due to excessive rainfall [7].
- Hurricanes – In 2017, the agricultural sector of Dominica sustained USD 380.2 million in losses [10]. The Caribbean Disaster Emergency Management Agency (CDEMA) reported that Hurricane Maria, 2017, destroyed 100% of Dominica's agricultural sector. In their assessment CDEMA reported severe damage to farm housing, irrigation, infrastructure, feeder roads, forest reserves, coastal fisheries and widespread loss of poultry [11].

## **Climate Information for Agriculture**

The WMO-designated Regional Climate Centre (RCC) for the Caribbean hosted by the CIMH produces a range of climate information products and tools that help the sector to better manage these events.

The suite of operational climate monitoring and forecast products cover all Caribbean countries and offer agriculturalists information about potential hazards or opportunities. For example, the climate monitoring products document significant recent past weather and climatic conditions allowing farmers to better understand these events and how they affect current crop and livestock status, while the climate forecast products systematically assess the relative chance of a particular climate-related event occurring 3 to 6 months in advance – giving farmers early warning of favourable or adverse operating conditions in the coming months.

### Water Shortage/Availability

- Caribbean climatology identifies one dry and one wet season each year (except in the Guianas), which coincides with the May/June to November/December hurricane season.
- In a region like the Caribbean, which mostly practices rainfed agriculture, the percentage of freshwater use by agriculture would be lower, but also signifies that the sector is vulnerable to the variable nature of its rainfall.
- The Caribbean region accounts for 7 of the top 36 water stressed countries in the world, with Barbados being in the top 10 (WRI, 2013).

### Implications for Agriculture

- Depending on pre-existing conditions such as soil type, inclination, etc, prolonged periods of rain can lead to soil erosion, water logging, landslides, impeded drying of produce conditions favourable to crop and livestock pest development and have negative effect on pollination and pollinators.
- In cases of insufficient irrigation, a typical dry spell of 7 days can impact crop production depending on soil properties related to soil moisture retention and drainage, and depth.
- Floods damage standing agricultural crops and may also carry away the top soil making the land barren.
- Hydrologic (below-average precipitation along with diminished surface water and groundwater) and biophysical (heat stress on crops and animals) stresses, in tandem, can lead to decreases in crop and livestock sales, increases in production costs, or both.
- The only good associated with floods is that sometimes it leaves behind fertile soil on the land after the floods.
- Dry conditions are beneficial in the development of some crops such as sugarcane, where a brief dry spell is essential during the pre-harvest stage which helps to increase the sucrose content of the sugarcane.
- Lower incidence of pests and diseases may occur during dry conditions.
- Transport firms involved in shifting fodder/hay and livestock benefit from dry conditions.

Precipitation-related products may help farmers manage precipitation extremes. These include:

<u>Climate Events</u>	<u>Monitors</u>	<u>Outlooks</u>	<u>Bulletins</u>	<u>Online Portal</u>
<ul style="list-style-type: none"><li>• Drought</li><li>• Dry Spell</li><li>• Wet Spell</li><li>• Flood</li></ul>	<ul style="list-style-type: none"><li>• SPI Monitor</li><li>• SPEI Monitor</li></ul>	<ul style="list-style-type: none"><li>• The CariCOF Caribbean Climate Outlook</li><li>• The CariCOF Drought Outlook</li><li>• The CariCOF Dry Spells Outlook</li><li>• The CariCOF Wet Spells Outlook</li></ul>	<ul style="list-style-type: none"><li>• The Caribbean Drought Bulletin</li><li>• The Caribbean Agro-Climatic Bulletin of the CariSAM</li></ul>	<ul style="list-style-type: none"><li>• CARISAM Portal</li></ul>

### Heat Stress

- The Caribbean Heat Season is the part of the year during which we regularly get excessively hot days and heat waves.
- Few excessively hot days and heatwaves before 1995. Many more excessively hot days and heatwaves since 1995.
- Heat Season mostly restricted to August-October before 1995. Heat Season now twice as long. Due to global warming, typically the Caribbean Heat Season now is from May-October, but heat waves can occur as early as March and as late as November. The greatest risk for heat stress will occur during these months.

### Implications for Agriculture

- **Crops:** Increased evapotranspiration, induced sterility in certain crops, poor vernalization.
- **Livestock and poultry:** Heat stress in livestock and poultry production is very common, and on the increase in tropical regions like the Caribbean. Heat stress affects feed intake, growth rate and reproductive performance; the animal's immune system and even the amount of red blood cells in livestock - which increases animal susceptibility to various diseases
- **Farmers:** The impact of heat on the health and productivity of Caribbean farmers is an ongoing concern

Temperature products may help farmers manage heat exposure to their animals and crops, as well as themselves. These include:

<u>Climate Events</u>	<u>Monitors</u>	<u>Outlooks</u>	<u>Bulletins</u>	<u>Online Portal</u>
<ul style="list-style-type: none"><li>• Prolonged number of hot days</li><li>• Heatwaves</li></ul>	<ul style="list-style-type: none"><li>• Mean Temperature Anomalies</li></ul>	<ul style="list-style-type: none"><li>• The CariCOF Caribbean Climate Temperature Outlook</li><li>• The CariCOF Heat Outlook</li></ul>	<ul style="list-style-type: none"><li>• The Caribbean Health-Climatic Bulletin</li><li>• The Caribbean Agro-Climatic Bulletin of the CariSAM</li></ul>	<ul style="list-style-type: none"><li>• CARISAM Portal</li></ul>

The range of temperature and precipitation-related climate monitoring and forecast products, mentioned above, are updated monthly by a large team of regional and national level climate experts. Operationally, the monthly timestep is already useful for agriculture – helping the sector to make better decisions.

In a recent study of the economic impact of seasonal drought forecasts information Service in Jamaica, Raman et al. highlights the benefits of the provision of timely climate information services to over 300 farmers during June 2014 to June 2015 [9]. The study concludes that when farmers are faced with uncertainty of limited available water, provision of information about water availability can improve their decision-making since losses in agricultural production for the farms that used climate early warning information was less than losses experienced by farms that did not.

Some of these products are co-produced in close association with key agriculture partners such as CARDI.

#### The Caribbean Agro-Climatic Bulletin of the CariSAM

This is an operational tool that helps the agricultural sector to manage climate risk and take advantage of climate opportunities. More specifically, this Bulletin:

- Helps agricultural practitioners understand significant recent past weather and climatic conditions essential to agriculture at National, Regional and Local levels.
- Is an industry source for forecasted agro-climatological conditions along with descriptions of possible events on agricultural production.
- Provides practitioners with average extreme values of agro-meteorological elements, with information presented as graphs, tables, drawings, maps, satellite imagery and text.
- Presents an overview of the status of agricultural production, including forestry and livestock.
- Offers climate smart advisories and recommends mitigation measures to prompt adaptive responses.
- Can help the water sector to address demand issues from the agricultural and food security sector for the upcoming forecast period.

All products are freely available on the Caribbean RCC website at <http://rcc.cimh.edu.bb>.

#### **Improving the provision of climate information for agriculture**

The Caribbean RCC continues to improve the range and quality of climate information to the benefit of Caribbean agriculture.

Farmers and extension officers have flagged a paucity of weather and climate information from agricultural areas, which would be more applicable to their operations (CAMI project, 2010-2013). Higher resolution data would provide more relevant output and would require a denser network of meteorological instruments and greater allocation of resources to cover the many agro-climatic zones. In recent times, CIMH has supported a number of initiatives such as the Improving Climate Data Information Management Project (ICDIMP) [13,14], that have increased the density of weather stations at fine time scales in digital formats. The Caribbean RCC is also actively investigating how data from the network of meteorological instruments can be supplemented by satellite data, further increasing the resolution of input weather and climate data.

Currently, the Caribbean RCC is testing and implementing a series of experimental products applicable agriculture, including (1) seasonal heatwave frequency outlooks (up to 6 months), (2) seasonal dry spell frequency outlooks (3 months), seasonal rainfall exceedance outlooks for crop water demand (3 months) and drought monitoring SPI and SPEI change maps.

Moreover, CIMH maintains a close working relationship with CARDI, AACARI and FAO for the express purpose of developing new specialised and integrated (ie. climate and

agriculture) products and services. Ongoing and future work includes the development of thermal heat indices for small ruminants, the identification of country-specific drought thresholds for national Agricultural Disaster Risk Management plans, calibrating a crop water productivity model to simulate crop water and irrigation requirements, and developing forecasting systems for pest and disease like Black Sigatoka and whitefly.

CIMH is also working towards updating climate information products on temperature and rainfall at a sub-seasonal timescale – better helping the sector to make important decisions.

### **Supporting Practitioner Application of Climate Information**

Agriculture Extension Officers provide a valuable service to the agricultural sector and the agricultural sector stands to gain if Caribbean Extension Officers are better equipped through training in relevant aspects of agrometeorology [16]. However, most of these officers are ill-equipped to provide important advice with respect to weather and climate issues. In an era of changing climate and increased weather and climate risk, advice on these issues is becoming increasingly important.

Agricultural practitioners can already access the portal of the Caribbean Society for Agro-Meteorological (CariSAM) - an already established interactive online platform designed to enhance collaboration and dialogue in the community and to be a hub providing weather and climate information, as well as applied research in agro-meteorology and related sciences both from the region and around the world. Importantly, the portal has the potential to build the capacity of agricultural practitioners to use climate information. The Portal serves as:

- weather and climate information resource to the Caribbean agriculture and food security sector.
- A source that supports meteorologists and climatologists to provide better tailored climate information products and services for the sector. These include national and regional agro-meteorological bulletins, climate outlooks and weather forecasts.
- A publication hub showcasing state-of-the-art applied research in agro-meteorology and related sciences from the region and around the world.
- A discussion forum featuring sessions designed to facilitate collaboration and dialogue on important agro-meteorological issues in the Caribbean.
- An online training centre offering webinars and courses to enhance the knowledge and application of weather and climate information and use of new tools.

In addition, CIMH offers countries technical training and support in climate-smart approaches for agriculture. One internationally recognised approach already pioneered in Guyana and Dominica is Participatory Integrated Climate Services Agriculture (PICSA); which aims to enable farmers to make informed decisions based on accurate, location specific, climate and weather information; locally relevant crop, livestock and livelihood options, and with the use of participatory tools, aid their decision making. The information provided would be able to guide Agriculture Extension Officers and the farmers they advise on what type of crops and livestock to invest in by determining which crops are resilient or suitable, and options possible that would reduce their vulnerability to potential climate shocks for the upcoming season. Another such mechanism are farmer's forums. A farmer's forum is medium designed to help farmers become more self-reliant in dealing with weather and climate issues that affect agricultural



production on their farms. The overall goal of the farmers' forums is to secure farmer self-reliance, through helping them to be better informed about effective weather and climate risk management by sustainable use of natural resources for agricultural production. These forums are generally held at the national level and is attended by farmers, extension officers, other agricultural officers and officials from national and regional bodies; such as CARDI.

Agriculture and climate are strongly interlinked and as such climate risk management is crucial to the sustainable development of the agricultural sector within any economy. The Caribbean RCC continues to support climate risk management within the agricultural sector and strongly believe that climate risk management within the region can be enhanced by good policy making. The policy suggestions made within this brief are grounded in reality and thought-through as to their benefit to agriculture within the region.

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The Caribbean Pilot Programme for Climate Resilience (PPCR) is a climate change adaptation initiative of the global PPCR supported by the Climate Investment Funds. The Caribbean PPCR has two complementary tracks. The first track consists of country based investments in six vulnerable countries and the second is a regional track involving regional organizations working in the Caribbean in key sectors.

Main objectives:

1. To improve regional processes to acquire, store, analyse access and disseminate climate relevant data
2. To pilot and scale up innovative climate resilient initiatives in the region

For more information on the Caribbean PPCR, please visit <https://caribppcr.org.jm>

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