Enhancing Farming through Weather and Climate Information

CARIBBEAN AGRO-METEOROLOGICAL INITIATIVE

POLICY BRIEF

Tapping into the potential of weather and climate services: A new asset for Caribbean food security

Introduction

Food security is of great concern to national governments in the Caribbean. This is particularly the case given increasing food prices globally coupled with high food imports, the global recession, and declining food production in the region. Despite this, **the agricultural sector remains pivotal to the fortunes of the Region's efforts to attain food and nutrition security**. Agricultural development is also essential in improving intra-regional trade in food and agricultural products, boosting export earnings, creating employment and the development of rural communities.

Some of the problems facing the agriculture sector include: losses in preferential markets (for example for sugar and bananas in Europe), inefficient production, slow traditional farming methods, soil erosion, slow technological advances, pests and diseases, shortage of inputs, and destructive impacts from weather and climate extremes.

The Caribbean region is vulnerable to a wide range of natural hazards, many of them meteorological; including floods, droughts, tropical cyclones and extreme temperatures. Other hazards associated with pests and diseases in plants, animals and humans are strongly driven by weather and climate. These disasters cause much suffering, infrastructure and environmental damage, aggravate food insecurity and slow down or even reverse development gains. These impacts are noticeably more significant in poor rural communities.

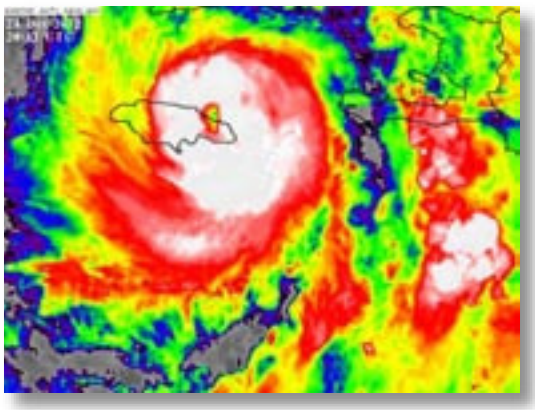
Summary of
Key Points and Recommendations

Key Points	Recommendation
Sufficient competent staff at the National Meteorological Services (NMS), dedicated to agro-meteorology, is necessary to deliver information requested by farmers and extension officers.	Adequate Human Resources and structural changes at NMS that support weather and climate services for agriculture. Financial resources for developing competent staff to deliver agrometeorological services.
In a changing climate it is imperative that Extension agents be better equipped to advise farmers on issues related to weather, climate and climate change.	Support specialised training for staff of Agricultural Extension Services in agrometeorology.
Collaboration and data (meteorological, biological, soil, management) sharing among agricultural ministries, meteorological services, water, statistical, environmental and other related agencies is critical for success.	Policies and protocols put in place within and between government, statuary departments and research institutions that encourage collaboration, data sharing and centralizing of agrometeorological data.
Continued sensitisation of farmers, rural community groups, and the general public to the importance of weather and climate information in farming and the interpretation of relevant weather and climate products in support of decision making is critical.	Farmers forums to continue, led by the NMSs, particularly just prior to the beginning of the wet/hurricane and dry seasons. Radio and television programmes and newspaper articles can be used to supplement the awareness.
Appropriate means of dissemination of weather and climate information that ensure that farmers are reached, and are presented in a language that farmers can understand; needs greater attention.	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.
There is a paucity of data 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.	Financial 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.
National Tri-partite committees, made up of meteorologists, extension officers and farmers as core groups, have been formed that would oversee and support sustainability of the activity begun under CAMI.	The committee should be ratified by government and report to the Ministry of Agriculture, particularly at times of threatening weather and climate conditions. These committees can be either expanded to, or play an advisory to role of Disaster Risk Reduction Committees in Agriculture.

Driven by the CAMI philosophy, this policy brief will examine:

- The enhancement of data collection, management, sharing and dissemination
- Capacity Building needs
- The use of models and statistics for farming
- The provision of Higher Resolution Information
- Strengthening Communications

Most importantly, the brief provides recommendations for further action to reduce agricultural risks due to weather and climate threats.



Hurricane Sandy crossing eastern Jamaica on 24 October, 2012

In 2004, due to Hurricane Ivan, Grenada's agricultural sector suffered almost US$40 million in losses with damage to the nutmeg industry, affecting the approximately 30,720 persons (about 30% of its population) it directly and indirectly employed (OECS 2004). Rainfall variability often results in droughts and floods with significant impacts on agricultural production. In a region where rain-fed agriculture still dominates, any reduction in rainfall during the growing season below what is normal can have negative consequences for agriculture. Farrell et al (2010) reported that drought in 2009 to 2010 was the most severe in decades causing crop and livestock losses, increases in food prices, reduction in export of some commodities like bananas, and increased pumping costs for irrigation. On the other hand, flooding also results in major and frequent losses: for example, in Guyana in 2005, flooding resulted in 59.5 % GDP in total losses with US $55 million from agriculture alone (ECLAC 2005), which was followed by another flood event the next year (ECLAC 2006). Hence, it is important to raise the awareness of the farming community in the Caribbean region to such weather- and climate-related impacts, and to products and services that could reduce their vulnerability and associated risks.

Flooded fields in Guyana in 2005

Research has suggested that, in the future, the Caribbean is very likely to warm, which trends have suggested is already occurring. The region is also **likely**, particularly in the Greater Antilles during the summer, **to experience reduced rainfall and more frequent droughts, accompanied by more frequent episodes of high intensity rainfall which can lead to flooding. Recent research has also suggested that the annual number of category 4 and 5 hurricanes occurring in the North Atlantic is likely to increase.** These, combined with rising temperatures and sea levels expose regional agriculture to greater risk.

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A framework to maximize the agrometeorological contribution to regional sustainable economic development

The Caribbean Agrometeorological Initiative (CAMI) was funded by the European Union through the Science and Technology Programme of the African, Caribbean and Pacific Group of Countries' (ACP). CAMI was launched in February 2010 by the Caribbean Institute for Meteorology and Hydrology (CIMH) and the following partners: Caribbean Agricultural Research and Development Institute (CARDI), the World Meteorological Organization (WMO) and ten National Meteorological Services of CARICOM states (www.cimh.edu.bb/cami).

The overarching objective of CAMI was to increase and sustain agricultural productivity at the farm level in the Caribbean region through improved applications of weather and climate information, using an integrated and coordinated approach. This was specifically done through:

1. provision of relevant climate information,
2. predictions on seasonal rainfall and temperature,
3. support for improved irrigation management,
4. the development of strategically selected weather-driven pest and disease models,
5. use of crop simulation models,
6. training of staff of National Meteorological Services (NMS) and two relevant regional research institutions
7. the staging of forums for farmers and Agriculture Extension officers to begin dialogue and assist them in interpreting information and products.

Enhancing data collection, management, sharing and dissemination

There are many sources of meteorological, biological and soil data in the individual countries. An integrated science like agrometeorology requires the use of all these types of data, which must therefore be available to those performing the analyses and developing agri-related products.

Through another project, Rescue and Digitization of Meteorological and Hydrological Data, executed by CIMH and funded by the Caribbean Development Bank; focus has been placed on improving the archiving, sharing and dissemination of weather, climate and water-related data. The value of the wide expanse of weather and climatic data was made clear, such that it can offset operational costs. However, for research and information and product development, like those needed in agriculture, data must be made available with some restrictions on use and provision to a third party.

It is also important to record data at resolutions and locations appropriate for farm production. Traditionally in the Caribbean, rainfall and other weather data was recorded at plantations, suggesting the importance placed on such information by the colonial powers. There are now fewer stations in operation. The loss of these stations must be halted, and in fact should be enhanced by the use of the relevant Automatic Weather Station sensors in these locations, which have the added benefit of recording data at fine time scales in digital formats. Resources should also be made available to maintain existing stations. In most, if not all the countries, data are recorded by public and private entities outside the Meteorological Services.

Efforts must be made by such entities to share their data so that the relevant applications for the benefit of the public can be made. There should also be national and regional centralised databases for agrometeorological data. The benefit of modern technology is such that data can be easily transmitted to central databases and readily converted for the relevant applications.

Automatic weather station

Even though there has been particular emphasis here on making weather and climate data more available for farming, as indicated earlier, the provision of biological and soil data is also critical. In more recent decades, there appears to be much less emphasis placed on collection of crop, pest, pathogen and soil data, necessary for the models used in the region. Important biological data include infection severity, number of damaged plants, number of insects in the cases of pests and diseases; and phenology, leaf area, economic and biomass yields in the case of crop simulation modeling. Data on soil would involve soil class/type, available water capacity, readily available water, and soil nutrient composition. Data on management practices are also important. Such data include plant density, amount and timing of fertilizer applied, and method of irrigation. The examples presented here are far from exhaustive. There must be much greater effort and strategic planning for the enhancement of the data collection and databases. Protocols must also be established for the collection and dissemination of these data types as well.

Capacity Building: Training and Human Resources are necessities.

Given the small size of the countries in the Caribbean, human resources is limited, particularly those trained to provide weather and climate services and applications. However, through a concerted regional approach, such services could be made available to the farming community.

Capacity building has begun, and must continue, in areas such as estimating evapotranspiration and irrigation requirements, pests and diseases modeling, crop growth and development simulation, climatic data analyses, and weather and seasonal climate forecasting and their applications to agriculture. Training must also continue for farmers in the interpretation of weather and climate information.

Statistical Climatology Training Workshop

National Meteorological Services need to make structural changes that exhibit a thrust toward providing weather and climate services for national development, including information for sectors such as agriculture, water and disaster management.

One of the major capacity needs is trained, competent staff in agrometeorology or applied meteorology within the National Meteorological Services to deliver products to stakeholders. In order for this to be realised, many of the National Meteorological Services need to make requisite changes to their structure. A possible new approach to structural change could exhibit a thrust toward providing weather and climate services for national development. This would include information for sectors such as agriculture, water and disaster management.

Another consideration for the future is to place greater emphasis on farmers' responses to or mitigation of potential yield-compromising weather and climate conditions. For example, what can a farmer do to reduce risks when a season of excessive rainfall is predicted? Besides irrigation requirements what preparatory steps can be taken when a drought or dry spell is predicted? Considering a future under a changed climate, what are some of the means of adaptation?

Row covers and greenhouses as adaptation options to climate variability and change

Agriculture Extension Officers, even though becoming a rare breed in tropical agriculture, have been providing important advice and support for farmers. However, it was found that 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. Caribbean Extension Officers must therefore be made better equipped through training in relevant aspects of agrometeorology.

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The use of models and statistics to aid farmers

National Meteorological Services are encouraged to do more with their data than just store and disseminate. Statistical methods facilitate information availability on dry spell probabilities, rainfall return periods, rainfall and temperature extremes and detection of climate trends. With this work, informed decision making at varying time and geographical scales are now possible. The trend analyses can corroborate (or refute) the notions of already-experienced climate changes. CAMI and other regional research efforts do illustrate upward temperature trends in recent decades.

If such experiences of climate changes are verified through statistical analyses, the question that comes to mind is "What are the implications of such projections on the agriculture sector. Results from crop simulation models suggest that yields of important crops in the region are likely to decline, threatening the livelihood security of farmers and food security of the region.

However, with information from such models, farmers can decide on species and varieties to plant in different agroclimatic zones, while maximising natural and financial resources at their disposal. What is also possible is the assessment of genetic traits that would allow better adaptation to future conditions, thus maintaining a satisfactory level of production, while efficiently managing critical resources such as water.

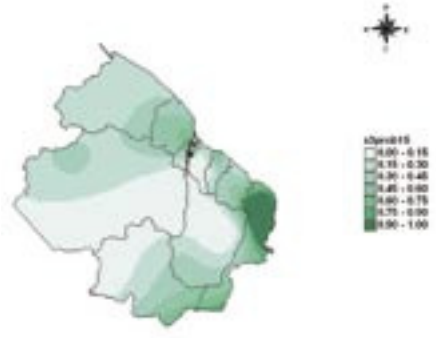
Major disaster risks are created by the prevalence of crop and animal pests and diseases, the initiation and development of which are also driven by weather and climatic conditions. Information on the likely development or spread of organisms will be an asset in crop protection, with an added benefit of reducing chemical input costs, as applications would be done as needed. What about future risks from these organisms? Certainly, pests and diseases models can be used to assess future risks due to climate change.

In presenting model output, utilisation of Geographical information Systems (GIS) is also critical. Areal analyses and illustration of geographical differences in exposure, vulnerability and risks are important to decision and policy making. Future training in GIS solutions for National Meteorological Services would be a great asset.

Provision of Higher Resolution Information.

Requests for higher-resolution and timely climate information and forecasts came clearly from the farming community. These often require a denser network of meteorological instruments and greater allocation of resources to cover the many agro-climatic zones. Farmers and extension officers have highlighted the paucity of weather and climate information from agricultural areas, which would be more applicable to their operations. Higher–resolution data acquired from a denser network of stations will provide more relevant output from the many statistical, crop simulation and pests and diseases models earlier discussed. These would be more valuable to farmers and Extension Officers.

As an example of provision of higher resolution forecasts, in response to a call by Jamaican farmers for such forecasts, the Jamaican Meteorological Service developed a web portal to meet this need (*http://agrilinksja.com/*). As one can imagine, this information also serves beyond agriculture. This needs to be extrapolated across the region, but the dedicated, trained resources must be allocated.



Probability of 15 day dry spells during August to October in Northern Guyana using GIS Technology.

Jamaica weather forecast regions.

Strengthening Communication

It is critical to develop a clear understanding of farmers' and agricultural stakeholders' data and information needs and to match those needs with what the Meteorological Services are able to provide. If farmers do not gain an economic benefit from the information and services provided, then they will not use them, and it is clear from the farmers themselves that such potential economic gains exist. A number of suggestions were made as to areas that might be of value to farmers. However, these would need to be shaped, prototyped, and continuously evaluated, with regard to their value creation, in association with the 'end-customers' – i.e. the farmers.

To this end, facilitated interactive communication and collaborative sessions and channels need to be expanded in order to enhance communications between all key stakeholders. Besides the initial needs relevance must be ensured, maintained and improved over time through a continuous monitoring and evaluation process.

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The choices of channels for delivery, whether bulletins, web pages, print or electronic media, need to be clarified by all the stakeholders and training in information use and interpretation at the farmer level needs to continue. Communication specialists and virtual channel facilitators are of primary importance and everything needs to be presented in a farmer-friendly manner.

Many of these media choices have been elaborated at national Farmers' Forums and are available in the various reports *(www.cimh.edu.bb/cami)*. But it is clear that appropriate channels vary. There are the technologically-savvy farmers with access to internet and cellular phones, but on the other hand there are farmers that have to resort to newspapers, radios and hard copy bulletins. There are also those calling for more radio and television programmes that will continue to heighten awareness. Further, there are farmers not as au-fait with the National Standard languages, and would prefer translation of forecasts and other relevant information into Spanish (in the case of Belize) and French creole (in the eastern Caribbean).

It is only by developing mutually beneficial win-win outcomes that any agro-meteorological communications strategy will succeed. Unless the strategy delivers valuable information to farmers in the farmers' own language that generate economic benefits, through channels that farmers prefer to use, and with the appropriate timing, then it will not succeed. But the quest for this success is vital for the region's food security, particularly in a changing climate.

References and Further Reading

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