



CLIMATE HEALTH AUDIT TOOL

REGIONAL HEALTH
AUDIT OF CLIMATE
AND VECTOR BORNE
DISEASES DATA

HAITI, ST. LUCIA, JAMAICA

PILOT PROGRAMME FOR
CLIMATE RESILIENCE (PPCR),
University of the West Indies,
Mona

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REGIONAL HEALTH AUDIT OF CLIMATE AND VECTOR BORNE DISEASES DATA

CLIENT:

CARIBBEAN REGIONAL TRACK OF THE PILOT PROGRAMME FOR
CLIMATE RESILIENCE (PPCR), UNIVERSITY OF THE WEST INDIES
MONA/CARIBBEAN PUBLIC HEALTH AGENCY

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STUDY OBJECTIVES

The study team's objective was to develop an audit tool capable of assessing country and regional climate-vector-disease data collection, documentation, reporting, and overall programmatic execution. We focused on three climate-health domains including disease surveillance, vector surveillance, and climatology/meteorology. We piloted the tool in three countries: Haiti, St. Lucia, and Jamaica. The tool was designed to capture current practices but also serve as a means to assess funds of knowledge across the domains. Finally, we hope to understand and frame the capabilities and capacities for developing collaborations in developing and executing climate-driven arboviral forecasting systems.

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1 EXECUTIVE SUMMARY

Emerging and re-emerging vector borne diseases (VBDs) are responsible for major public health crises throughout the tropics and subtropics. Numerous factors are driving the expansion of vector habitats and infection and disease attack rates. Diseases such as dengue, chikungunya, and Zika are a few recent examples of the clinical, societal, and financial burdens which disease outbreaks and endemic transmission generate. The impact of climate on the spread and sustainment of VBDs is becoming increasingly recognized and acknowledged as a key driver. The objective of this study was to further explore this area.

The objective of this study was to further explore the impact of climate on the spread and sustainment of vector-borne diseases (VBDs)



The study team created a climate and health audit tool for conducting a data audit on Caribbean climate and arbovirus data in three countries, Haiti, St. Lucia, and Jamaica, as part of the Pilot Program for Climate Resilience (PPCR) health initiative. The audit tool was designed for multiple types of stakeholders specifically focused on three domains: disease surveillance (human health data, case reporting, epidemiology), vector surveillance (entomological indicators, vector control), and climatology/meteorology (climate data, meteorological records reporting). The initial study objective was to assess the data collected, recorded, reported, and maintained within each of these domains; the tool is therefore divided into these domains. The tool was designed to capture current practices but also serve as a means to assess funds of knowledge across the domains. Finally, we hope to understand and frame the capabilities and capacities for developing collaborations in developing and executing climate-driven arboviral forecasting systems.



Study team observations from the audits and the over-arching concepts which rose to the surface included; 1) the interface between climate, vector abundance, and human infection and disease was clearly appreciated by the key stakeholders in the three countries; 2) there was significant variance in available resources, capabilities, and capacities between the countries and across the domains; 3) there was significant variance in the maturity of programs and plans to address the climate-vector-disease interface; and 4) there was significant variance across the countries in the tools available and utilized to collect, document, and report data and information. More specific observations and findings include:

- Vector surveillance in Haiti was the most under-resourced program, and monitoring is conducted mostly in response to new clinical cases; proactively conducting vector indices monitoring is not occurring. Haiti's surveillance tools are used based on product availability and calls for action from Haiti WHO in-country representative. There is no pre-established plan; actions are taken in reaction to data provided by specific localities in need.

- ▶ In St. Lucia, vector surveillance is ongoing with Vector Officers visiting approximately 300 homes a day to conduct both passive and active surveillance.
- ▶ In Jamaica, vector surveillance focuses more on passive surveillance but in some cases will conduct active surveillance in outbreak periods. Jamaica also deploys a tremendous amount of resources to mosquito prevention at the beginning of every wet season employing over 1000 new field techs to help decrease mosquito populations.
- ▶ Across the board, vector surveillance expressed that monitoring households can be difficult with lack of resources and support.
- ▶ All countries are looking to conduct more insecticide resistance testing and incorporate more elaborate electronic database systems.
- ▶ Many stakeholders mentioned that key personnel have been trained in geographic information system (GIS) development, but few areas have implemented the use of GIS for vector dynamics.
- ▶ Stakeholders also believe it is important to better link epidemiology data to vector data for better risk analysis determination. In Jamaica, biostatisticians are plotting disease cases on temperature and precipitation data but would like to expand on this area.

In conclusion, each country articulated that they are experiencing a significant, and increasing, public health burden resulting from VBDs and climate appears to be a key driver of this trend. Key stakeholders across the climate-vector-disease continuum exist in each country and each country possesses tools and expertise to address issues in these areas. Unfortunately, significant variance exists across the countries in terms of resource availability, capabilities, and capacities. These variances will significantly limit the region's ability to comprehensively address the challenges posed by changes in climate.

In summary, the study team's audit tool and approach to audit was highly successful in engaging country level stakeholders and identifying key strengths and strategic gaps in plans, processes, and resources. Follow on studies are essential to increase understanding of the 'problem' and allow for more informed programmatic decision-making and resourcing.

2 PURPOSE & BACKGROUND

The University of the West Indies (UWI), through its Mona Office for Research and Innovation (MORI), selected the SUNY Upstate Medical University, Institute for Global Health and Translational Sciences (IGHTS) and the Research Foundation for SUNY (“RFSUNY”) to receive funding in response to the RFP “Selection of a Consultant to Conduct a Regional Health Audit of Climate and Vector Borne Diseases Data”. The overall goal of the program, funded by the Inter American Development Bank with regional support, is to “improve regional processes of climate relevant data acquisition, storage, analysis, access, transfer and dissemination and to pilot and scale up innovative climate resilient initiatives.” Study objectives included:

- ▶ To develop a regional health audit tool, and
- ▶ To conduct a regional audit of available climate and vector borne disease data

Project deliverables included:

- ▶ Inception Report
- ▶ Draft Audit Tool
- ▶ Draft Report of findings of audit (this document)
- ▶ Final Audit Report

The audit tool is designed for multiple types of stakeholders, primarily in three specific domains:

1. Disease surveillance (human health data, case reporting, epidemiology)
2. Vector surveillance (entomological indicators, vector control)
3. Climatology/meteorology (climate data, meteorological records reporting)

3

CHALLENGES AND SUCSESSES IN TOOL DEVELOPMENT AND USE DURING THE PROJECT

We found that developing the tool presented us with an interesting opportunity to bring together stakeholders and experts with a range of experience. We started with three key actions: Develop, Ask, Adapt, shown here in Figure 1. We used online collaboration through Zoom meetings to consult with both CARPHA and CIMH, to develop our ideas. We then asked ourselves, a group of researchers looking to inform modeling and forecasting exercises, which data will be important, and for stakeholders, what information do we want. We then drew on our expertise and experience with recent projects to adapt an existing audit tool, and to retain the flexibility needed to address different countries than previous projects.



FIGURE 1: DEVELOPING AND DRAFTING THE AUDIT TOOL - FIRST STEPS.

3.1 CHALLENGES

STAKEHOLDER STRUCTURES DIFFER:

Due to different national and sub-national level governmental structures, the stakeholder networks and structures also differ. This made a one-size-fits all audit tool complicated, and necessitated adapting and reshaping as we progressed. Some questions were deemed to be redundant, and we adapted by using matrix style questions with checkboxes instead of repeating the same question. In other situations, questions were not structured to capture the full scope of response easily – for example, documenting all meteorological stations and their data. We adapted by developing a table template in the questionnaire and in Excel, so we could easily communicate with the interviewees, and let them participate in the process transparently.

CONCURRENCE PROCESS:

We were unaware of the process of concurrence at the outset of the project, and due to the short term of the contract (~4 months), the process of concurrence led to logistical complications.

POLITICS:

Working in Haiti was complicated by security issues due to ongoing political struggles. We were fortunate to have a Haitian team member who was able to manage meetings while remaining safe.

3.2 SUCCESSES

AUDIT TOOL DEVELOPMENT PROCESS:

Collaborative online discussions were beneficial and productive; previous experience with CIMH and the BRCCC project provided a great lens. CIMH provided wonderful insight and a knowledge base about the meteorological stakeholders in the region.

AUDIT TOOL 'TOOLS':

Describing data sheets within the tool, and creating metadata for each sector interviewed, enabled us to discuss design and data structures with modelers throughout the process, and refine variables as needed. This was facilitated also by our inverted process of designing the output data prior to questionnaire development.

ENTHUSIASTIC RESPONSES:

We encountered a keen desire to describe data, a keen desire to have more cross-collaborative work, and a lot of discussions about the need for more tools and training in data management and analyses.

ADDITIONAL INFORMATION:

Stakeholders identified areas of interest in climate and health beyond arboviral, interests in climate impacts on multiple sectors through cross-disciplinary efforts. This is a great avenue for future capacity building and identifying stakeholder collaborative potential.

RESULTS OF THE AUDIT

This Report comprises the 9 questionnaires that follow: 3 countries (Haiti, St. Lucia, Jamaica) with responses on 3 sectors or domains each (disease surveillance, vector surveillance, climatology/meteorology). The questions are specific to sector, comprising both simple yes/no questions, and more comprehensive checklists; some are multi-part, requiring running through suites of questions per data type question (e.g. which arbovirus, which meteorological station).

This document presents the questionnaires as interview tools to guide the interview process and record answers. An Excel template describing the metadata and questionnaire answers from the 3 sectors accompanies this report.



4.1 KEY CONTACTS

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4.2 DISEASE SURVEILLANCE - ARBOVIRUS REPORTS

1. **Date of interview:** November 6, 2019

2. **Interviewer Initials:** WD

3. **Interviewee initials:** RB

4. **Country:** Haiti

5. **What institution is responsible for disease surveillance?**

The Direction d'Epidémiologie de Laboratoire et de Recherche (DELR) du Laboratoire National de Santé Publique (LNSP) which is an organ of the Ministry of Health (MoH) in charge of data regulation and consolidation. The DELR has a focal point for epidemiology and statistics in each of the 10 administrative departments of Haiti.

The DELR is responsible for planning, regulating and coordinating all information received on the main priority diseases, both communicable and non-communicable, with a view to maintaining a system of early warning and to promote the integration of prevention and protection activities related to these different diseases, into the programmed actions at all levels of the health pyramid. Regarding disease surveillance, the DELR is responsible to:

- plan and organize epidemiological surveillance of priority communicable and noncommunicable diseases in national and departmental structures;
- ensure the development and dissemination of the instruments for collecting health statistics;
- coordinate, in coordination with the Programming and Evaluation Unit, the processing, analysis and dissemination of institutional health statistics;
- ensure the establishment of norms and standards to strengthen the capacity of departmental structures in these areas;
- coordinate the development of the National Public Health Laboratory
- ensure quality control and performance of medical laboratories, especially in decentralized structures;
- plan, promote and develop research, analysis and dissemination of results;
- strengthen sub regional collaboration in epidemiology;
- prepare and disseminate a periodic, regular report covering its areas of competence;

6. **Do you keep records for (Y/N)**

a. **DENV** YES

b. **CHIKV** YES

c. **ZIKV** YES

For each arbovirus 'Y' above, answer questions 7-26

7. How are arbovirus cases reported? (short answer) DENV CHIKV ZIKV

Currently only DENV cases are diagnosed and reported. Since 2018 no cases of CHIKV and ZIKV have been diagnosed. In every hospital throughout the country, healthcare workers report all febrile cases to general surveillance officers who register information regarding the cases in a book. From this book a specific epidemiological surveillance officer reports all cases to an online platform for Monitoring, Evaluation and Integrated Surveillance (MESI) accessible to the DELR for follow-up.

	DENV	CHIKV	ZIKV	OTHER
8. Is data collected on patient age? (Y/N)	YES, but group of ages	YES, but group of ages	YES, but group of ages	NA
9. Is data collected on patient gender? (Y/N)	YES	YES	YES	NA
10. Is data collected on patient ethnicity? (Y/N)	NA	NA	NA	NA
11. Is data collected on patient occupation? (Y/N)	No	No	No	NA
12. Date of symptom onset (Y/N)	YES	YES	YES	NA
13. Symptoms (Y/N)	YES	YES	YES	NA
14. Initial diagnosis (Y/N)	YES (on the cases book but not on MESI)	YES (on the cases book but not on MESI)	YES (on the cases book but not on MESI)	NA
15. Final diagnosis (Y/N)	YES (on the cases book but not on MESI)	YES (on the cases book but not on MESI)	YES (on the cases book but not on MESI)	NA
16. Do you collect patient home address (Y/N)	YES	YES	YES	NA
17. Do you record clinic address/name (Y/N)	YES	YES	YES	NA

18. How are cases diagnosed (clinical diagnosis, laboratory diagnosis)?

DENV	<p>Besides the data from all the clinics throughout the country, the LNSP has established a network of 16 formal sentinel clinical sites for arbovirus surveillance: Clinically an evaluation is performed by a physician to assess the association of signs and symptoms, linked with past medical, personal history and the residential area. Then choices are made randomly to draw blood specimen and send to the LNSP for further analysis.</p> <p>Laboratory: General lab tests based on differential diagnosis are performed at the sentinel sites and Trioplex Real-time RT-PCR assay are done by trained lab technician at the DELR services from the LNSP level.</p>
CHIKV	<p>Besides the data from all the clinics throughout the country, the LNSP has established a network of 16 formal sentinel clinical sites for arbovirus surveillance: Clinically an evaluation is performed by a physician to assess the association of signs and symptoms, linked with past medical, personal history and the residential area. Then choices are made randomly to draw blood specimen and send to the LNSP for further analysis.</p> <p>Laboratory: General lab tests based on differential diagnosis are performed at the sentinel sites and Trioplex Real-time RT-PCR assay are done by trained lab technician at the DELR services from the LNSP level.</p>
ZIKV	<p>Besides the data from all the clinics throughout the country, the LNSP has established a network of 16 formal sentinel clinical sites for arbovirus surveillance: Clinically an evaluation is performed by a physician to assess the association of signs and symptoms, linked with past medical, personal history and the residential area. Then choices are made randomly to draw blood specimen and send to the LNSP for further analysis.</p> <p>Laboratory: General lab tests based on differential diagnosis are performed at the sentinel sites and Trioplex Real-time RT-PCR assay are done by trained lab technician at the DELR services from the LNSP level.</p>

19. Who conducts laboratory diagnoses of dengue/zika/chikungunya cases?

DENV	Trained lab technicians at the DELR services
CHIKV	Trained lab technicians at the DELR services
ZIKV	Trained lab technicians at the DELR services

20. What lab methods are used?

DENV	Trioplex Real-time RT-PCR assay
CHIKV	Trioplex Real-time RT-PCR assay
ZIKV	Trioplex Real-time RT-PCR assay

21. Is there historical data available on the prevalence of different DENV/CHIKV/ZIKV serotypes? (Y/N)

DENV	CHIKV	ZIKV	OTHER
Yes, for serotype 1 Dengue since 2013 after the revision of the case definition	Yes, for CHIKV since 2016	Yes, for ZIKV since 2016	

22. What is the spatial and temporal resolution of existing case records?

DENV	Spatial and temporal resolution of data are not generated systematically but only for research activities. Otherwise information on patient's location are available in the records.
CHIKV	Spatial and temporal resolution of data are not generated systematically but only for research activities. Otherwise information on patient's location are available in the records.
ZIKV	Spatial and temporal resolution of data are not generated systematically but only for research activities. Otherwise information on patient's location are available in the records.

	DENV	CHIKV	ZIKV	OTHER
23. Are there electronic patient records or another electronic epidemiological database centralized for the country? (Y/N)	There're no electronic patient records but there's a centralized epidemiological database (MESI)	There're no electronic patient records but there's a centralized epidemiological database (MESI)	There're no electronic patient records but there's a centralized epidemiological database (MESI)	
24. Are cases georeferenced? (Y/N)	No; technicians and field workers are trained to georeferenced but it is not a systematic activity.	No; technicians and field workers are trained to georeferenced but it is not a systematic activity.	No; technicians and field workers are trained to georeferenced but it is not a systematic activity.	

25. By whom?

DENV	Not Applicable
CHIKV	Not Applicable
ZIKV	Not Applicable

26. Since when?

DENV	Not Applicable
CHIKV	Not Applicable
ZIKV	Not Applicable

4.3 VECTOR SURVEILLANCE – VECTOR CONTROL

1. **Date of interview:** October 23, 2019
2. **Interviewer Initials:** WD
3. **Interviewee initials:** MT, MGF, WS and JRVC
4. **Country:** Haiti
5. **What institution is responsible for vector surveillance and control?**
 - National Program for Malaria and Filariasis Control (PNCMF)
 - Through the Zika AIRS Project (ZAP) led by Abt Associates, USAID was actively reducing populations of the mosquito that carries Zika by building national and regional capacity to conduct vector control and surveillance for Zika and future mosquito-borne outbreaks. Program implementation in Haiti began in June 2016 and ended in September 2019. The PNCMF is now taking over all vector-borne diseases control and surveillance. Haiti's vector control operation is conducted by twelve entomological monitoring and vector control units referred to as brigades. Each of the 10 departments has a brigade composed of four field workers and a supervisor; there are two additional brigades for the metropolitan area surrounding Port-au-Prince and two additional for the Grand-Anse department. The brigades do not fall under a national framework for arbovirus control for now, and generally work in an ad hoc fashion, their target locations based on local epidemiology reports.
6. **What is the management structure of vector control and surveillance (e.g., decentralized versus centralized)?**
 - Except for Malaria and Filariasis, there was no management structure strictly under control of the Ministry of Health. The PNCMF is working now to extend the program and have an integrated management structure. It will take the central command and control the health institutions through 10 departmental health officers. At the institutional and community level, the field workers (Agent de Santé Communautaire Polyvalent: ASCP) will be trained to ensure the management.
 - There appears to be good coordination between health care providers relating to various notifiable diseases, including Zika, Chikungunya and Dengue. There is an excellent central database system for notifiable diseases, run and maintained by the Direction d'Epidémiologie, de Laboratoire et de Recherches (DELR) and accessible by computer at the district clinics. Data are analyzed, mapped, and disseminated by DELR to all stakeholders. The DELR system does not include data relating to surveillance and control of arboviral vectors; these are either stored on paper or input into local computers. The Public Health Laboratory (LNSP) does have the capability to perform insecticide resistance tests using the CDC bottle bioassay technique, and these data are available to inform the brigades as to suitable insecticides for use against Aedes mosquitoes.

7. What vector surveillance tools are used? (Y/N, details)

- a. Larval surveys: YES
- b. Pupal surveys: YES
- c. Ovitrap: YES
- d. CDC light traps: YES
- e. Prokopack backpack aspirators: YES

Note: These surveillance tools are used based on tools and products' availability and calls for action from Haiti WHO in-country representative. There is no preestablished plan, actions are taken based on epidemiological data from specific localities in need.

8. Entomology facilities and staff:

- a. **Is there access to an Entomology Laboratory?** Yes, the entomology lab is located at the National Public Health Laboratory (LNSP)
- b. **Are entomological samples brought back to the lab for identification?** Yes
- c. **Also, are persons trained in Entomology (qualified entomologists) or technicians trained in mosquito identification?** Yes, At the highest level of planning and producing guidelines for the control of arbovirus transmitting mosquitoes, there are currently only two entomologist positions in the PNCMF. Other technicians have also been trained to conduct larval and adult bioassays to detect chemical resistance using the CDC bottle bioassay technique. Due to the location of the insectary/entomology laboratory within the same compound as the LNSP and PNCMF, the dissemination of information such as bioassay results to the relevant stakeholders should be easy.

9. How frequently are homes visited for vector surveillance and control? (e.g. months)

Continuous efforts are being made despite a lack of resources. The brigades conduct home visit every day but to different areas. There is no specific frequency for activities, actions are taken based on the epidemiological reports, priorities and sometimes on emergencies.

10. Is there focal control (in and around presumed positive cases)?

Yes, there's an epidemiological officer in each health institution. He reports to the health communal office which reports to health departmental direction and prepare reports or request actions from central office.

11. What are the primary control methods for *Aedes aegypti*? (Y/N, plus details)

- a. Larvicide (temefos, BTI, juvenile growth regulators): YES
- b. Indoor residual spraying: YES
- c. Ultra-low volume (ULV) fogging: YES
- d. Elimination of containers: YES
- e. Use of petroleum products in standing water: NO
- f. Biological control (e.g. copepods or larvivores fish)? NO

Note: These methods are used in localities based on call for action from epidemiological case reports.

12. If yes to residual spraying (IRS) or fogging (ULV): what chemical(s)?

BTI and artellic

13. Do you conduct surveillance of insecticide resistance? (Y/N)

YES, the last resistance test was conducted in the Grand-Anse department on September 2019.

14. If yes to surveillance of insecticide resistance: when?

No specific time. Actions are taken to calculate the impact of the products based on incidence and programmatic area.

15. If yes to surveillance of insecticide resistance: where?

Works are being done in all 10 departments in collaboration with the LNSP where an insectarium is installed. Currently a lot of efforts are being deployed specifically in the Grand-Anse department.

16. If yes to surveillance of insecticide resistance: how often?

Regularly, but there is no specific schedule.

17. If yes to surveillance of insecticide resistance: what protocol is used? (e.g. CDC/WHO/bioassays, screening for alleles)

CDC/WHO

18. If yes to surveillance of insecticide resistance: what insecticides are screened for?

Malathion, deltamethrin, bendiocap and permethrin

19. What is the timing (schedule) of vector control interventions (e.g., seasonal, monthly, random)?

There is no specific timing, control interventions are conducted based on the persistence of products used and the human cases data.

20. What is the signal for intervention? Are there thresholds for interventions? (e.g. #mosquitos in traps, human case data, etc)

There is no specific signal for intervention.

Surveillance of Aedes aegypti includes which of the following variables and what is the frequency (e.g. weekly, monthly, seasonal, random) of the data collected:

VARIABLE	(Y/N)	FREQUENCY
21. GPS points (geographic location)	Y	Inconsistent frequency
22. Specific Address	Y	Inconsistent frequency
23. Breteau Index	Y	Inconsistent frequency
24. House Index	Y	Inconsistent frequency
25. Pupal Indices	Y	Inconsistent frequency
26. Container Indices	Y	Inconsistent frequency
27. Adult Indices	Y	Inconsistent frequency
28. Housing Characteristics	Y	Inconsistent frequency
29. Presence of febrile infections	Y	Inconsistent frequency
30. Household demographics	Y	Inconsistent frequency
31. Insecticide resistance	Y	Inconsistent frequency
32. Indoor vs outdoor location of mosquitoes	Y	Inconsistent frequency
33. Species of mosquitoes	Y	Inconsistent frequency
34. Local Temperature	Y	Inconsistent frequency
35. Local Precipitation	Y	Inconsistent frequency

36. Is there a national electronic database with historical vector surveillance data? What data are they (e.g. ovitrap, larval surveys, etc. what time-span and frequency?)

No for now, but efforts are being made to develop it. A database exists for notifiable diseases and vector surveillance activities and it is archived in PNCFM's computers and used for quarterly and annual report.

37. What is the spatial and temporal resolution of the national data?

N/A

38. Has the vector surveillance data been georeferenced?

Yes

39. By whom?

By an Engineer attached to the PNCFM, his technical assistants in each department of the country, by the brigades' supervisor or the field workers.

40. Since when?

Since 2016



4.4 METEOROLOGY/CLIMATOLOGY

1. **Date of interview:** 10/22/19 and 10/23/19
2. **Interviewer Initials:** WD
3. **Interviewee initials:** LMR, ME and JC
4. **Country:** Haiti
5. **Who generates weather forecasts, seasonal forecasts, climate change projections?**
 - Hydro-meteorology Unit (UHM), Ministry of Agriculture;
 - National Center for Geospatial Information Centre (CNIGS), Ministry of Planification and External Cooperation;
 - Catholic Religious Congregation: Frères de l'Instruction Chretienne (FIC)

It is important to mention that as part of the implementation of the institutional reform process undertaken by the Ministry of Agriculture, Natural Resources and Rural Development in Haiti, it was decided to establish the Hydrometeorological Unit (UHM) comprising the National Meteorological Center and the National Service for water resources. The UHM is subdivided into four distinct services:

- Hydrometeorological observation service, development and operation of measurement networks in hydrometeorology.
- Meteorological and hydrological forecasting services
- Service of climatology and database in charge of the analysis of the evolution of the climate - Water Service in charge of water resources management

6. How does your institution distribute their climate information?

On the basis of the specific information provided by its international partners via extranet sites (National Weather Service, Météo-France, European Centre for Medium-Range Weather Forecasts and the Norwegian Meteorological Service), forecasters analyze meteorological contexts and prepare forecasts recorded manually and represented in the following forms: following:

- A meteorological context bulletin for the next 3 days (without associated map) with general information for the Caribbean and the Atlantic, and a zoom always in the form of text on Haiti and detailed forecasts for Port au Prince;
- A five-day technical bulletin for the sole purpose of Civil Protection Direction (CPD);
- A specific bulletin for the Port au Prince airport and messages framed for aeronautical assistance.
- In the event of a threat of dangerous weather, vigilance and warning bulletins are produced and disseminated.

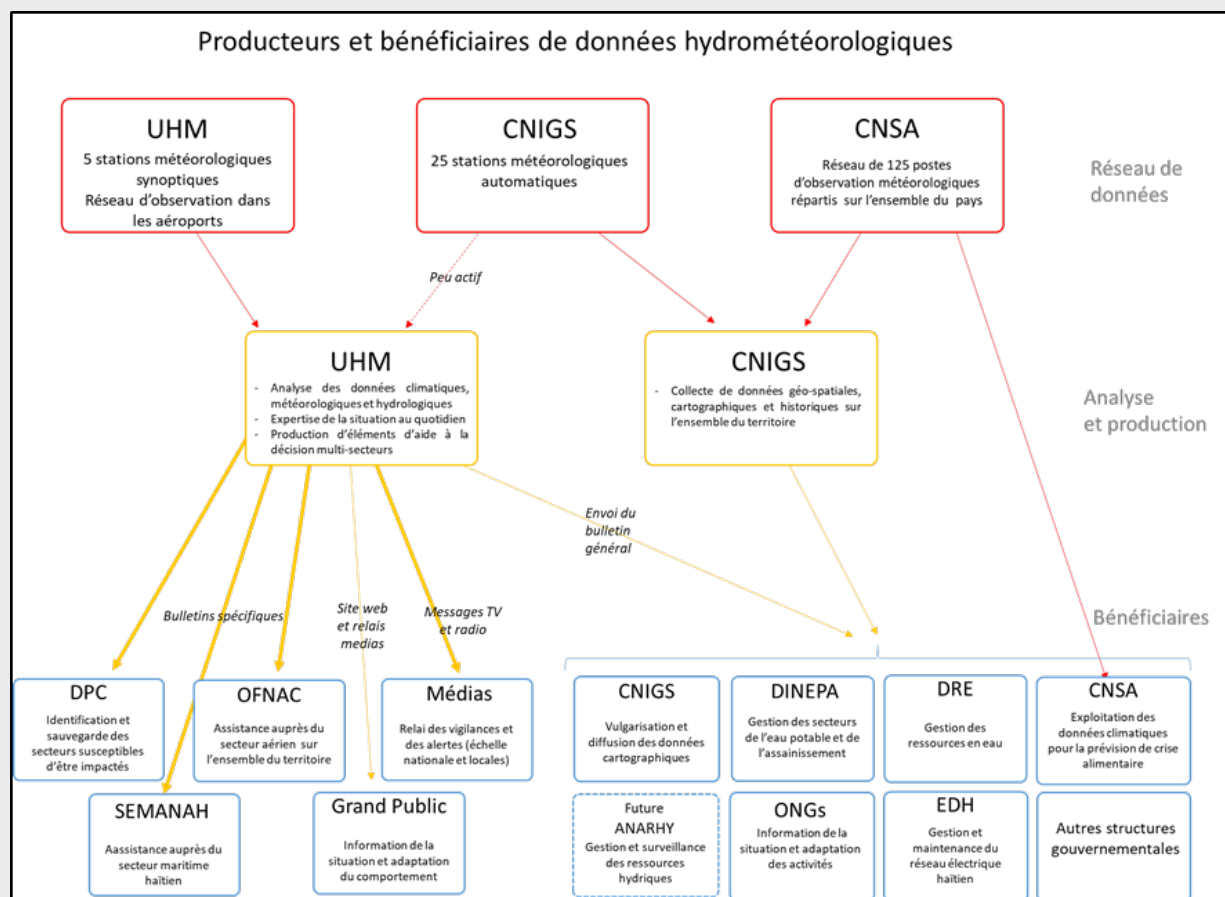
These newsletters are produced once a day, 7/7 days and sent to the press and radio stations. For national television, the forecaster travels to the studio every day to record the video bulletin, apart from any contract with the UHM.

In addition, this service relies on the Flash Flood Guidance System (FFGS), considered as a crucial tool for flood assessment. Internationally recognized, this system is widely used by forecasters, especially during cyclonic crises.

Finally, for the near future, a new bulletin to come, intended for coastal users of the sea (coastal BMS) will complete this list of products published by the CNM.

It should be noted that all UHM product broadcasts are transmitted only by one dissemination vector: the sending of email from a "private" google account and not an institutional address.

In the field of meteorology and climatology, ministerial dispersion is less marked than in the field of water. Two main ministries oversee data production missions and hydrometeorological services: the Ministry of Agriculture, Natural Resources and Rural Development, which is responsible for overseeing the UHM and the Ministry of Planning and External Cooperation (MPCE), which oversees the CNIGS. To better illustrate our point, the diagram below simply wants to list the missions and relations existing between the different actors of the hydrometeorological sector.



PRODUCER-USER MAPPING OF HYDROMETEOROLOGICAL DATA**7. To whom is the information distributed?**

As explained in the previous question information is distributed to:

- Various national institutions for broadcasting
- Other national institutions and NGOs following specific request (e.g. road construction)

8. Is there a standardized database?

No for now but efforts are being made by the UHM and partners to implement a standardized database

9. What is the spatial and temporal scale of meteorological data?

- Normally, every day but variation can happen depending on the needs.
- Programming can be done for every 10 minutes, every hour or on a daily basis.

10. How many stations do you report from? (see details at the annexed excel file)

7 stations from the UHM, CNIGS and FIC (see table below)

STATION LOCATION/NAME	MANUAL OR AUTOMATIC (M/A)	DATES OF OPERATION (START, END, IF NOT CURRENT)	LAT/LONG	ELEVATION
Cap-Haitian International Airport, Northern Department, (UHM)	A	Operational	19.733400 and -72.195600	7 m
Port-au-Prince International Airport, Western Department, (UHM)	A	Operational	18.577500 and -72.293800	28 m
Jacmel Airport, South-East Department, (UHM)	A	Current minor technical breakdown	18.2372 and -72.518400	46 m
Les Cayes Airport, Southern Department (UHM)	A	Operational	18.271200 and -73.784300	63 m

STATION LOCATION/NAME	MANUAL OR AUTOMATIC (M/A)	DATES OF OPERATION (START, END, IF NOT CURRENT)	LAT/LONG	ELEVATION
Jérémie Airport, Grand-Anse Depatement, (UHM)	A	Operational	18.6627 and -74.1701	64 m
Ouanaminthe, North-West Department, (FIC)	M	Operational	19.5489 and -71.714776	32 m
Pignon, Northern Department (CNIGS)	A	Operational	19.3880 and 72.1312	367 m

11. What climate/weather variables are measured? What kind of measurements of thresholds, or periodic metrics? What other meteorological/ hydrological indices are measured? (Repeat for each station/ source listed above, if different)

VARIABLE	(Y/N)	FREQUENCY	UNITS/TYPE
Temperature	Y	Every hour and daily mean	Celsius degree
Precipitation	Y	----	Millimeter of rainfall
# Tropical nights	N		
Drought indices – e.g. Standardized Precipitation Index (SPI)	N		
Daily Temperature Range	Y	Daily	Celsius degree
# Wet days above a threshold	N		
Relative Humidity (RH)	Y	Every hour	Percentage
Other: Wind (force and direction)	Y	Every hour	Knot



5.1 KEY CONTACTS

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5.2 DISEASE SURVEILLANCE - ARBOVIRUS REPORTS

1. **Date of interview:** 12/3/19
2. **Interviewer Initials:** ARD SJR
3. **Interviewee initials:** CF
4. **Country:** St Lucia
5. **What institution is responsible for disease surveillance?**

Ministry of Health—Epidemiology

Epidemiology is responsible for all vector borne disease case work. Epidemiology is separated by district in which each district is composed of a health officer, pharmacist, educator, and nurse. Case data is used by epidemiology biostatistician on a weekly basis to produce reports for Ministry of Health (MOH) hospitals and Caribbean Agency for Public Health (CARPHA). Electronic data collection began in 2004 but became more extensive in 2006, data is entered into excel and is now georeferenced. Data is not accessible to public but can be obtained upon request with proper Institutional Review Board (IRB) and MOH documentation.

The department of Epidemiology has recently met with the Environmental Health (EH) to discuss new more efficient ways to collaborate between the two areas to decrease the risk of arboviruses in St. Lucia. At monthly report meetings Epidemiology reports cases and Environmental Health reports vector indices. One idea posed would be the creation of a merged georeferenced database used to create maps which combine vector and case data to help strengthen prevention campaigns. It was mentioned that awareness and educational campaigns need more work and Epidemiology believes that with further collaborations between them and EH would help to better sustain partnerships between communities and institutions and thus decrease the risk of infection across the island.

6. **Do you keep records for (Y/N)**
 - a. **DENV** YES
 - b. **CHIKV** YES
 - c. **ZIKV** YES
 - d. **Other?** Malaria and Leptospirosis

Note—Leptospirosis is also a major health concern; Epidemiology wants to devote more resources to understanding general vector dynamics.

FOR EACH ARBOVIRUS 'Y' ABOVE, ANSWER QUESTIONS 7-26

7. **How are arbovirus cases reported?**

DENV

Cases are either reported both laboratory confirmed or clinically confirmed. Clinical cases (especially those in which patients are hospitalized) require further investigation in which MOH deploys an officer from Epidemiology and Environmental Health, a community nurse, and a health educator to assess the patient's home and community for follow up intervention.

CHIKV

Cases are either reported both laboratory confirmed or clinically confirmed. Clinical cases (especially those in which patients are hospitalized) require further investigation in which MOH deploys an officer from Epidemiology and Environmental Health, a community nurse, and a health educator to assess the patient's home and community for follow up intervention.

ZIKV

Cases are either reported both laboratory confirmed or clinically confirmed. Clinical cases (especially those in which patients are hospitalized) require further investigation in which MOH deploys an officer from Epidemiology and Environmental Health, a community nurse, and a health educator to assess the patient's home and community for follow up intervention. Pregnant women were tested, and data was collected on the number of positive and negative cases throughout the country and whether babies were born with microcephaly.

	DENV	CHIKV	ZIKV	OTHER
8. Is data collected on patient age? (Y/N)	YES	YES	YES	NA
9. Is data collected on patient gender? (Y/N)	YES	YES	YES	NA
10. Is data collected on patient ethnicity? (Y/N)	YES	YES	YES	NA
11. Is data collected on patient occupation? (Y/N)	YES	YES	YES	NA
12. Date of symptom onset (Y/N)	YES	YES	YES	NA
13. Symptoms (Y/N)	YES	YES	YES	NA
14. Initial diagnosis (Y/N)	YES, hospital cases	YES, hospital cases	YES, hospital cases	NA
15. Final diagnosis (Y/N)	YES	YES	YES	NA
16. Do you collect patient home address (Y/N)	YES	YES	YES	NA
17. Do you record clinic address/name (Y/N)	YES	YES	YES	NA

18. How are cases diagnosed (clinical diagnosis, laboratory diagnosis)?

DENV	Clinically diagnosed then a portion is sent to CARPHA for laboratory confirmation
CHIKV	Clinically diagnosed then a portion is sent to CARPHA for laboratory confirmation
ZIKV	Clinically diagnosed then a portion is sent to CARPHA for laboratory confirmation
	Zero reporting —point is to prove that we have no cases so we still are testing when a physician suspects possible case and sample is sent to CARPHA

19. Who conducts laboratory diagnoses of dengue/zika/chikungunya cases?

DENV	Two public hospitals one in the north and one in the south are responsible for dengue laboratory diagnosis. All private hospitals samples are sent through the national reference laboratories. A portion of the samples are also sent to CARPHA.
CHIKV	Two public hospitals one in the north and one in the south are responsible for laboratory diagnosis. All private hospitals samples are sent through the national reference laboratories. A portion of the samples are also sent to CARPHA.
ZIKV	Two public hospitals one in the north and one in the south are responsible for laboratory diagnosis. All private hospitals samples are sent through the national reference laboratories. A portion of the samples are also sent to CARPHA.

20. What lab methods are used?

DENV	N/A
CHIKV	N/A
ZIKV	In Victoria hospital mothers were tested for Zika via urine or blood samples.

21. Is there historical data available on the prevalence of different DENV/CHIKV/ZIKV serotypes? (Y/N)

DENV	CHIKV	ZIKV	OTHER
YES, But complicated because samples are not always collected in time and cannot be processed.	NO	NO	

22. What is the spatial and temporal resolution of existing case records?

DENV

Weekly reporting is syndromic from clinics, wellness centers and hospitals in which all enter data into a health information system. Hospitals have infection control measures and are following up on cases to determine lab confirmation. No data is collected for negative cases. Private labs report when there are positive cases only. It is uncertain how far back health information system usage and data goes back. However, in general case data is available as far back as 2004.

CHIKV

Weekly reporting is syndromic from clinics, wellness centers and hospitals in which all enter data into a health information system. Hospitals have infection control measures and are following up on cases to determine lab confirmation. No data is collected for negative cases. Private labs report when there are positive cases only. It is uncertain how far back health information system usage and data goes back. However, in general case data is available as far back as 2014.

ZIKV

Weekly reporting is syndromic from clinics, wellness centers and hospitals in which all enter data into a health information system. Hospitals have infection control measures and are following up on cases to determine lab confirmation. No data is collected for negative cases. Private labs report when there are positive cases only. It is uncertain how far back health information system usage and data goes back. However, in general case data is available as far back as 2016

Throughout the zika epidemic, MOH conducted general education campaigns on mosquitoes and zika. All pregnant mothers were monitored, and data was collected on the number of positive and negative cases throughout the country, if a case presented positive the mother received follow up care and monitoring to term and continued monitoring postdelivery. Dr. Gardener from early childhood development is leading a zika cohort follow up and special attention is paid to positive microcephaly cases. All data were shared with epidemiology, and positive cases were sent to CARPHA. In Victoria hospital mothers were tested for zika via urine or blood samples.

Electronic database have original case data, demographics and addresses. MOH has recently discontinued the use of the zika database since there have been no recent cases reported.

	DENV	CHIKV	ZIKV	OTHER
23. Are there electronic patient records or another electronic epidemiological database centralized for the country? (Y/N)	YES—excel of arbovirus case data.	YES—excel of arbovirus case data.	YES—excel of arbovirus case data.	
24. Are cases georeferenced? (Y/N)	YES	YES	YES	

25. By whom?

DENV	Biostatistics personnel have created case data maps that they hope to eventually combine with environmental health unit vector data.
CHIKV	Biostatistics personnel have created case data maps that they hope to eventually combine with environmental health unit vector data.
ZIKV	Biostatistics personnel have created case data maps that they hope to eventually combine with environmental health unit vector data.

26. Since when? N/A

5.3 VECTOR SURVEILLANCE – VECTOR CONTROL

1. **Date of interview:** 12/3/19
2. **Interviewer Initials:** ARD SRJ
3. **Interviewee initials:** CC
4. **Country:** St. Lucia
5. **What institution is responsible for vector surveillance and control?**
Environmental Health Unit Vector Control with help from PAHO, CARPHA, Zika AIRS Project (ZAP) and USAID by building national and regional capacity to conduct vector control and surveillance for Zika and future mosquito-borne outbreaks.
6. **What is the management structure of vector control and surveillance (e.g., decentralized versus centralized, other structure - elaborate)?**
Centralized—there are three Environmental Health Officers and 20 Vector Control Officers working in three offices and one new insectary that are responsible for conducting daily surveillance, control and educational campaigns across the island.
The insectary was funded by the ZAP project.
7. **What vector surveillance tools are used? (Y/N, details)**
 - a. **Larval surveys** YES
 - b. **Pupal surveys** YES
 - c. **Ovitrap** YES
 - d. **CDC light traps** YES
 - e. **Prokopack backpack aspirators** NO
 - f. **Other?** BG sentinels, gravid traps, and emergent traps when they are available.

Note: Tool usage depends on external agencies such as CARPHA, USAID, PAHO etc. for tools so at times they may only have 5 to 6 adults traps for example. CARPHA provides some training for the use of new equipment.

8. **Entomology facilities and staff:**
 - a. **Is there access to an Entomology Laboratory? (Y/N)**
YES—the first ever insectary, larval room, adult room, and testing room. Currently there is no water or electricity, but the plan is to have it launched beginning of 2020. The insectary is a 40 ft container converted into an insectary. Also, a new diagnostics facility is to come next year as part of the Ministry of Agriculture.
 - b. **Are entomological samples brought back to the lab for identification? (Y/N)**
Yes, ovitraps egg samples are sent to CARPHA a few times a year. Moving forward with the new insectary equipment they hope to confirm samples yearround onsite and then send eggs to CARPHA every six months for confirmation.

c. Also, are persons trained in Entomology (qualified entomologists?) or technicians trained in mosquito identification? (Y/N and elaborate)

The country has two medical entomologists which train vector control officers in the lab and field.

***Notes:** As part of having the new insectary they plan to have insecticide resistance testing particularly malathion bottle bioassays. Also testing will be conducted not only for *Aedes aegypti* control efforts but *Anopheles* and *Culex quinquefasciatus*, Cu. Qu, which are found in small pockets. They shared that they are worried about Malaria and West Nile.*

9. How frequently are homes visited for vector surveillance and control? (e.g. months, or if not regular, elaborate)

Around 300 homes are visited daily across the island in an organized manner by 20 vector control officers. They look in containers for eggs, larvae, and pupae (i.e. tires, water tanks, bottles, buckets, and natural containers like coconut shells, septic tanks, gutters, flowerpots inside house). Vector control also deploys BG sentinel traps inside houses to trap adult mosquitoes when they have access to traps. The traps are placed inside the house to prevent batteries from being stolen. They use BG trap commercial lures.

10. Is there focal control (in and around presumed positive cases)? (Y/N, details)

YES—Vector control will receive notice from Epidemiology team of a positive case and will then visit the household and community. The visit is conducted by an Environmental Health Officer, Epidemiology Officer, Community Nurse, and Vector Control Officer and Health Educator. The team will distribute larvicides, fog, and talk to community members about prevention.

***Notes:** For every community visit larval and breteau indices are generated, if these indices are high vector control tries to do a cleanup campaign.*

***Health education:** Vector control conducts vector awareness week at the beginning of each rainy season with funding support from PAHO. There can be lack of continuity as funding runs out.*

11. What are the primary control methods for *Aedes aegypti*? (Y/N, plus details)

- a. Larvicide (temefos, BTI, juvenile growth regulators) YES—BTI
- b. Indoor residual spraying NO
- c. Ultra low volume (ULV) fogging YES
- d. Elimination of containers YES—solid waste management team
- e. Use of petroleum products in standing water NO
- f. Biological control (e.g. copepods or larvivorous fish)? YES—Vector control takes guppies from drains and raise them to prevent mosquitoes in septic tanks or bad drains.

12. If yes to residual spraying (IRS) or fogging (ULV): what chemical(s)?

Malathion and permethrin

13. Do you conduct surveillance of insecticide resistance? (Y/N) YES**14. If yes to surveillance of insecticide resistance: when? Not clear****15. If yes to surveillance of insecticide resistance: where?**

Currently conducting testing in the North but will begin to conduct island wide testing soon.

16. If yes to surveillance of insecticide resistance: how often?

Testing is conducted monthly, but the hope is to test more houses when they have the new lab finalized.

17. If yes to surveillance of insecticide resistance: what protocol is used? (e.g. CDC/WHO/bioassays, screening for alleles)

CDC and WHO bioassays for malathion and permethrin

18. If yes to surveillance of insecticide resistance: what insecticides are screened for?

Malathion and permethrin

19. What is the timing (schedule) of vector control interventions (e.g., seasonal, monthly, random)?

Daily or number of positive arbovirus cases

20. What is the signal for intervention? Are there thresholds for interventions? (e.g. #mosquitos in traps, human case data, etc.)

Breteau or larval indices—when indices are higher than normal interventions are put into place or when cases are high.

Surveillance of Aedes aegypti includes which of the following variables and what is the frequency (e.g. weekly, monthly, seasonal, random) of the data collected:

VARIABLE	(Y/N)	FREQUENCY
21. GPS points (geographic location)	Neighborhood locations are referenced	Daily Notes: recently started mapping. Will use GPS location a new vector such as A. albopictus was found
22. Specific Address	YES	Every day
23. Breteau Index	YES	Every day
24. House Index	YES	Every day
25. Pupal Indices	YES	Every day
26. Container Indices	YES	Every day

VARIABLE	(Y/N)	FREQUENCY
27. Adult Indices	YES	Weekly
28. Housing Characteristics	YES	NA
29. Presence of febrile infections	YES	NA
30. Household demographics	YES	NA
31. Insecticide resistance	Y	Monthly
32. Indoor vs outdoor location of mosquitoes	Y	Daily, indoor limited to traps
33. Species of mosquitoes	Y	Weekly
34. Local Temperature	N	NA
35. Local Precipitation	N	NA
36. Other	NA	NA

37. Is there a national electronic database with historical vector surveillance data? What data are they (e.g. ovitrap, larval surveys, etc. what time-span and frequency?)

Currently no, Environmental Health is set to join Epidemiology Health Monitoring Information System (HMIS) which has already been implemented in health centers. The system will first be implemented in hospitals and then to Environmental Health. Epidemiology wants to use Environmental Health data to generate stronger reports to prevent and control disease outbreak.

Two offices do send data via excel files to Environmental Health. Paper historic records were destroyed in a flood or lost during office moves.

38. What is the spatial and temporal resolution of the national data? (e.g. weekly/monthly/annual; municipal/regional/national) N/A

39. Has the vector surveillance data been georeferenced?

As of last year, neighborhood locations began to be mapped.

40. By whom?

Vector control officer that received training. They will start georeferencing ovitrap and adult data in 2020.

41. Since when? 2019

Notes: Ministry of Agriculture In collaboration with CIMH are trying to produce a magazine about possible climate driven agriculture related disease outbreaks. Ministry of Agriculture also provides media dissemination of vector borne diseases risks via radio and tv. They are urging farmers to clean tanks and use fishes. They produce a 45 second public service announcements as part of their talk show called Agriculture on the Move.

5.4 METEOROLOGY/CLIMATOLOGY

WATER RESOURCE MANAGEMENT AGENCY

1. **Date of interview:** 12/4/19
2. **Interviewer Initials:** ARD SJR
3. **Interviewee initials:** MM, AJ, VS and AI
4. **Country:** St Lucia
5. **Who generates weather forecasts, seasonal forecasts, seasonal climate outlooks, climate change projections?**
 - Weather Forecasts - Met Office
 - Seasonal Forecasts - Met Services
 - Seasonal Climate Outlooks - CIMH CARICOF
 - Climate Change Projections - CARICOF, OES, CRISPIN → Sustainable Development Climate Change

6. **How does your institution disseminate their climate information? (what communication channels are used, how is it distributed)?**

NATIONAL METEOROLOGICAL SERVICES (NMS) disseminates information via email and has a website that reports weather forecasts. They have currently drafted the first climate bulletin which is intended to report on a monthly basis. The bulletin provides an overview of current climate conditions, outlook of seasonal conditions 3-6 months in advance. It is tended to help stakeholders manage climate risk and help build resilience to climate related hazards. Stakeholder advisories include sectors such as tourism, energy, water, agriculture, health, and disaster planning. Met services also disseminate information at Flood and drought mitigation meetings. The committee of flood and drought mitigation is chaired by the head of meteorology and the goal is to apprise everyone of seasonal forecasts.

WATER RESOURCES MANAGEMENT AUTHORITY (WRMA) disseminates information during the monthly flood and drought cabinet committee meeting where they present water availability, river flows and rainfall. Information can also be requested by submitting a form to WRA.

7. **To whom is the information distributed?**

Key stake holders such as tourism, energy, water, agriculture, health, and disaster planning, and general public.

8. **Is there a standardized database? (Y/N) YES**

- a. **What does standardization entail? Is it conforming to an international standard, and which one?**

METEOROLOGICAL SERVICES — airport weather data collection conforms to World Meteorological Organization (WMO) and International Civil Aviation Organization (ICAO). They extract as simple text and then they produce excel files on request for anyone requesting data.

WATER RESOURCE MANAGEMENT AUTHORITY — standardized database for river flow and rain fall data. Information is collected and put on to excel spreadsheet and uploaded to web map and i-Data for storage purposes. Rainfall data is stored in house.

WRMA Notes: *Project standardization with WRMA is part of world bank funded project in collaboration with Disaster Vulnerability Reduction Project (DVRP) program initiative for the PPCR*

9. What is the spatial and temporal scale of meteorological data?

METEOROLOGICAL SERVICES contain 2 manual and 13 automatic stations however, not all working. Hewanorra International Airport 24 hours a day since 1973 and George F. L. Charles Airport has been recording hourly until last light since 1968. Automatic stations were installed in 2005. Met service automatic stations are live feed reporting every minute.

WATER RESOURCE MANAGEMENT AUTHORITY possess 40 total stations, twenty of which have been functioning for 5-10-years, they are trying to standardized their brands with CIMH but this is challenging as other projects have come in with different brands. WRMA checks three manual station daily. Semi auto stations have been collecting info since 1955. There are 21 river flow point measurements and 5 water level stations that they get water levels from every 15 minute. They have 4-5 officers that do semi auto and manual station data collection.

10. How many stations do you report from? (see details at the annexed excel file)

METEOROLOGICAL SERVICES reports from 2 manual and 13 automatic weather stations.

WATER RESOURCE MANAGEMENT AUTHORITY reports from 40 rainfall and river flow stations.

Note: *WRMA is now responsible for the management of Ministry of Agriculture small meteorological stations*

11. What climate/weather variables are measured? What kind of measurements of thresholds, or periodic metrics? What other meteorological/ hydrological indices are measured? (Repeat for each station/source listed above, if different).

VARIABLE	(Y/N)	FREQUENCY	UNITS/TYPE
Temperature	Y	Hourly	Celsius degree
Precipitation	Y	-----	Millimeter of rainfall
# Tropical nights	N	NA	NA

VARIABLE	(Y/N)	FREQUENCY	UNITS/TYPE
Drought indices – e.g. Standardized Precipitation Index (SPI)	Y	NA	standard deviation from the long-term mean
Daily Temperature Range	Y	Daily	Celsius degree
# Wet days above a threshold	Y	Daily	1mm = wet day 10mm or greater = extreme wet day
Relative Humidity (RH)	Y	Daily	Percentage
Other: Wind (force and direction)	Y	Daily	Hours

WRMA Notes: WRMA was established in 2006 as an agency program unit but was previously listed as a project. WRMA wants to become a statutory body so they can create all laws regarding water as they are currently part of centralized government and cannot do this. They work with several different departments including sustainable resource development, Environmental Health, and have a memorandum of understanding with the NMS, National Emergency Management Organization (NEMO), CIMH, national utilities commission (NUC), and utility board (WASCO).

WRMA is uploading all data to web maps and i-data as part of the PPCR project. Also, as part DVRP one of goals was to rehabilitate their network of instruments to create a unified database with NMS. This is currently still in progress, WRMA hopes to extend this project with world bank after 2019 to ensure that the projects is completed.

Red Cross is running a project to understand warning systems in communities related to flooding and understand what they do. Villages have disaster management committees that are trying to formalize.



6.1 KEY CONTACTS

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VECTOR CONTROL JAMAICA

6.2 DISEASE SURVEILLANCE - ARBOVIRUS REPORT

1. **Date of interview:** 12/10/19
2. **Interviewer Initials:** ARD
3. **Interviewee initials:** SHJ
4. **Country:** Jamaica
5. **What institution is responsible for disease surveillance?**
Ministry of Health Epidemiological Unit
6. **Do you keep records for (Y/N)**
 - a. **DENV** YES
 - b. **CHIKV** YES
 - c. **ZIKV** YES
 - d. **Other?** Malaria

FOR EACH ARBOVIRUS 'Y' ABOVE, ANSWER QUESTIONS 7-26

7. How are arbovirus cases reported?

DENV

Passive system, all arboviruses are considered notifiable diseases.

Surveillance is broken down by class:

- Class 1 — notified upon suspicion upon 24 hours (i.e., DENVH, nonendemic Malaria)
- Class 2 — suspicion of communicable disease notified by attending PA to medical health officer to parish level to MOH
- Class 3 —

CHIKV

Passive system, all arboviruses are considered notifiable diseases. See above.

ZIKV

Passive system, all arboviruses are considered notifiable diseases. See above.

	DENV	CHIKV	ZIKV	OTHER
8. Is data collected on patient age? (Y/N)	YES	YES	YES	NA
9. Is data collected on patient gender? (Y/N)	YES	YES	YES	NA
10. Is data collected on patient ethnicity? (Y/N)	NO	NO	NO	NA
11. Is data collected on patient occupation? (Y/N)	YES	YES	YES	NA
12. Date of symptom onset (Y/N)	YES	YES	YES	NA
13. Symptoms (Y/N)	YES	YES	YES	NA
14. Initial diagnosis (Y/N)	YES	YES	YES	NA
15. Final diagnosis (Y/N)	PCR confirmed cases take time, so during outbreak it is challenging to keep up with case reporting. If cases meet the outbreak case definition it is determined to be a suspected case. (i.e out of 5000 dengue cases of which 68 cases recently confirmed during outbreak). The UWI hospital and CARPHA are responsible for laboratory confirmations.			NA
16. Do you collect patient home address (Y/N)	YES	YES	YES	NA
17. Do you record clinic address/name (Y/N)	YES	YES	YES	NA

18. How are cases diagnosed (clinical diagnosis, laboratory diagnosis)?

DENV Clinical and some laboratory (very few)

CHIKV Clinical and some laboratory (very few)

ZIKV Differential system/ mostly clinical confirmations but some lab testing performed at CARPHA

19. Who conducts laboratory diagnoses of dengue/zika/chikungunya cases?

DENV	University of West Indies Laboratory Hospital and CARPHA
CHIKV	University of West Indies Laboratory Hospital and CARPHA
ZIKV	University of West Indies Laboratory Hospital and CARPHA

20. What lab methods are used?

DENV	PCR/ IGM/ IGG Elisa Tests
CHIKV	PCR/ IGM/ IGG Elisa Tests
ZIKV	PCR/ IGM/ IGG Elisa Tests

21. Is there historical data available on the prevalence of different DENV/CHIKV/ZIKV serotypes? (Y/N)

DENV	CHIKV	ZIKV	OTHER
YES—around the 1980s	Data recorded after initial outbreak	Data recorded after initial outbreak	

22. What is the spatial and temporal resolution of existing case records?

DENV	Spatial data is recorded across the island.
CHIKV	Spatial data is recorded across the island.
ZIKV	Spatial data is recorded across the island.

23. Are there electronic patient records or another electronic epidemiological database centralized for the country? (Y/N)

DENV	CHIKV	ZIKV	OTHER
Some	Some	Some	
YES	YES	YES	

24. Are cases georeferenced? (Y/N)

25. By whom?

DENV	GIS Specialist- Hector Burrows Epidemiology Department
CHIKV	GIS Specialist- Hector Burrows Epidemiology Department
ZIKV	GIS Specialist- Hector Burrows Epidemiology Department

26. Since when?

DENV	10-15 years prior
CHIKV	Since outbreak
ZIKV	Since outbreak

6.3 VECTOR SURVEILLANCE – VECTOR CONTROL

1. **Date of interview:** 12/10/19
2. **Interviewer Initials:** ARD
3. **Interviewee initials:** SHJ
4. **Country:** Jamaica
5. **What institution is responsible for vector surveillance and control?**
Ministry of Health Vector Control and Environmental Health
6. **What is the management structure of vector control and surveillance (e.g., decentralized versus centralized, other structure - elaborate)?**
The management structure of vector control and surveillance is both centralized and decentralized. Ministry of health is responsible for policy, training, auditing and setting guideline regulations. They consist of four operating arms referred to as regional authorities (NW, NE, SW, SE). At the central level is where the vector control unit resides. Regional arms are responsible for control implementation i.e. fogging efforts. At terms of human resource, we have a Medical entomologist that is head of the program at the parish level, areas are run by public health inspectors. They are responsible for supervision of vector control data.
7. **What vector surveillance tools are used? (Y/N, details)**
 - a. **Larval surveys** YES
 - b. **Pupal surveys** YES
 - c. **Ovitrap** YES—Sentinel surveillance system where they have 67 sentinel sites within each site there are 20 collection sites that are collected on a weekly basis
 - d. **CDC light traps** YES
 - e. **Prokopack backpack aspirators** NO
 - f. **Other?** BG sentinels, gravid traps, and emergent traps

Notes: 3 systems –

Rapid survey—at start of the year (parishes are asked to go into communities and collect info on demographics, environmental conditions, and population assessment of *A. aegypti* and *A. albopictus*. From that data they determine which communities are considered high risk for future outbreaks.

House to house inspection—on a day to day basis vector control team performs house to house inspections, breteau indices, container indices and environment conditions. On monthly basis they are tallying the data.

Enhanced program—Implemented between July and October MOH brings on over 1000 workers to conduct house to house inspections in which workers are trained to treat, identify key breeding grounds, educate and destroy breeding sites to prevent large scale outbreaks.

8. Entomology facilities and staff:

a. Is there access to an Entomology Laboratory? (Y/N) Yes, vector control national lab.

b. Are entomological samples brought back to the lab for identification? (Y/N)

Yes, across the whole island. Given consistency of outbreaks the Minister (who is an academic) thought it was important to create a research arm under the vector control program which is purely focused on looking at new tools and trying to understand the dynamics of transmission. Thus, in collaboration with UWI they created the Mosquito Control and Research Unit. Current research includes insecticide resistance work, and identifying arboviruses in mosquitoes, going forward they want to look at species dynamics and distribution. Other research includes testing natural repellents with the head of life sciences in UWI.

c. Also, are persons trained in Entomology (qualified entomologists?) or technicians trained in mosquito identification? (Y/N and elaborate)

There is one trained medical entomologist and technicians that are trained in larval identification and other entomological functions.

9. How frequently are homes visited for vector surveillance and control? (e.g. months, or if not regular, elaborate)

Homes are visited for vector surveillance and control on a weekly/daily basis. Reporting in high risk communities (includes approximately 550 communities across the island). The target is roughly 25- 35 homes per day but varies with topology and weather. There are approximately 202 key technicians during low transmission months and then 1000 workers are added when MOH is conducting enhanced programs during peak transmission. During the enhanced program the technicians are divided into teams of 8 and are assigned a particular number of communities for the period of engagement and are given a key performance indicator of 35 homes.

10. Is there focal control (in and around presumed positive cases)? (Y/N, details)

There is no active surveillance for arboviruses so by the time vector control receives a notification of a dengue case there will have been a bit of time between onset of sickness and the case notified to the public health system. So, there is a lag, however when the data does come the team does try to conduct an intervention with these homes, but it is not there focus. Their focus is on prevention and interventions in high risk community areas, urban centers and sports events. MOH has a system to determine where they will focus during non-outbreak and outbreak periods. The system is known as a dengue emergency response system, for example currently in this outbreak they have what they call primary, secondary, and tertiary areas of focus in order to not chase after cases. Primary areas consist of schools, urban centers, market places, and areas that they have had clusters of cases presented. Secondary areas include established high-risk communities; tertiary includes anything outside of those. They also divide parishes into key premises (tire shops, dump areas—aka high breeding zones), key institutions and key breeding containers to help better tackle outbreak prevention and control.

11. What are the primary control methods for *Aedes aegypti*? (Y/N, plus details)

- a. **Larvicide (temefos, BTI, juvenile growth regulators)** YES—Natilar and BTI, previously used abate but since it is an organic phosphate, they are giving it a rest. These two new larvicides are bio-larvicides.
- b. **Indoor residual spraying** NO—however, this is usually done for malaria but they are contemplating promoting the use of household aerosols in response to the current dengue outbreak. MOH will advise times lined up with fogging to maximize indoor outdoor control. But this is not proper wall application and is not conducted by MOH.
- c. **Ultra-low volume (ULV) fogging** YES—part of routine application for ULV and thermal fogging.
- d. **Elimination of containers** YES
- e. **Use of petroleum products in standing water** YES—diesel and food oil
- f. **Biological control (e.g. copepods or larvivorous fish)?** NOT MUCH— played with the idea of the tiki tiki fish

12. If yes to residual spraying (IRS) or fogging (ULV): what chemical(s)?

No residual spray just household indoor spray which is not conducted by MOH

13. Do you conduct surveillance of insecticide resistance? (Y/N) YES**14. If yes to surveillance of insecticide resistance: when? NA****15. If yes to surveillance of insecticide resistance: where? UWI research station in collaboration with MOH.****16. If yes to surveillance of insecticide resistance: how often? Once a year.****17. If yes to surveillance of insecticide resistance: what protocol is used? (e.g. CDC/WHO/bioassays, screening for alleles)**

CDC and WHO methods are used. They are also looking at PVO and other mechanisms for resistance.

18. If yes to surveillance of insecticide resistance: what insecticides are screened for?

All in use insecticides are being tested (i.e. Malathion). In a new study they are looking at current insecticides being used as well as new insecticides MOH hopes to incorporate.

19. What is the timing (schedule) of vector control interventions (e.g., seasonal, monthly, random)?

July- October MOH runs their enhanced program, since Jamaica is currently in an outbreak this enhanced program has been extended through March 2020.

20. What is the signal for intervention? Are there thresholds for interventions? (e.g. #mosquitos in traps, human case data, etc)

The signal usually is determined by human case threshold, if it exceeds the number of expected human cases the MOH declares an outbreak. They also are in the midst of determining whether they can use breteau indices to create earlier outbreak predictions. Under professor Chen at UWI climate was studied in regard to outbreak and determined moving average temperature which is an important dengue indicator UWI proposed for MOH to use but it is still not implemented.

Surveillance of Aedes aegypti includes which of the following variables and what is the frequency (e.g. weekly, monthly, seasonal, random) of the data collected:

VARIABLE	(Y/N)	FREQUENCY
21. GPS points (geographic location)	NO	--
22. Specific Address	YES	Routine
23. Breteau Index	YES	Routine
24. House Index	YES	Routine
25. Pupal Indices	NO	Only for research, or analysis of intervention
26. Container Indices	YES	Routine
27. Adult Indices	YES	Routine
28. Housing Characteristics	YES	Note if settlements are planned or unplanned, frequently piped water, and frequent solid waste management
29. Presence of febrile infections	NO	--
30. Household demographics	NO	--
31. Insecticide resistance	YES	Once a year
32. Indoor vs outdoor location of mosquitoes	YES	Routine
33. Species of mosquitoes	YES	Routine- adult and larvae
34. Local Temperature	NO	But data is available from climate sectors and they use that to plot case data
35. Local Precipitation	NO	But data is available from climate sectors and they use that to plot case data
36. Other	--	--

37. Is there a national electronic database with historical vector surveillance data? What data are they (e.g. ovitrap, larval surveys, etc. what timespan and frequency?)

Yes there is a national electronic database with historical vector surveillance data that has been running for approximately one year with efforts from the ZAP project. Ovitrap, insecticide, larval data, etc. and climate data from the National Meteorological Services are all part of the electronic system. A lot of the data is still paper based but now they have access to tablets, monitoring and evaluating programs with the help of the ZAP project. They are currently digitizing the ovitrap data from 2016 however the entomological *A. aegypti* data is very difficult. Paper based data goes back 40-50 years and is stored in individual parishes. Electronic data goes back 15 to 20 years (excel), and consists of breteau indices, container indices, house index and environmental housing characteristics.

38. What is the spatial and temporal resolution of the national data? (e.g. weekly/monthly/annual; municipal/regional/national)

The sentinel data is being georeferenced since 2019.

39. Has the vector surveillance data been georeferenced?

MOH wants to be able to georeference sentinel sites, but at this time it is difficult. PAHO has conducted several trainings for the use of QGIS software and Jamaica was provided with 100 tablets from the ZAP program and have begun digitalizing all vector data.

40. By whom? N/A

41. Since when? N/A



6.4 METEOROLOGY/CLIMATOLOGY

1. **Date of interview:** 10/29/19
2. **Interviewer Initials:** ARD AMS
3. **Interviewee initials:** JS
4. **Country:** Jamaica
5. **Who generates weather forecasts, seasonal forecasts, seasonal climate outlooks, climate change projections?**

NATIONAL METEOROLOGICAL SERVICE generates weather forecasts, seasonal forecasts and climate outlooks. University of West Indies uses National Meteorological Service raw data to create climate change predictions and projections. The national weather service is located at the airport and climate forecasts and outlooks are constructed from said data. Water Resource Authority provides all data online open source www.wra.gov.jm for access to all stream flow and well data, historical and current total monthly stream flow and water level data.

WATER RESOURCE AUTHORITY upgraded their collection methods with the PPCR so that the climate sector can have more accurate data for climate predictions to understand responses to climate change. Previously all stations were analog and collected info every 30 days. Today with PPCR and World Bank they now have automatic stations. Forty four stations provide stream flow and intensity rainfall data. Rainfall and stream flow data are measured in the same stations together. The island is divided into 3 regions, region 1 is the middle of the island, region 2 is the western side and region 3 is the eastern side. For region 3 WRA now has a couple of stations that are specially selected because of its important contribution to agriculture—these stations are in real time. WRA would like all 44 stations to be real time but difficult to maintain financially so only in key areas do they collect real time data. Other data is collected every 15 minutes but is transmitted every hour. Not real time data collections include 63 stations + spot measurements. Spot measurements are performed in areas in which stations were damaged but data collection continues in order to maintain long term data sets.

WRA also generate early warning flood system funded by PPCR. Messages are sent to emergency management and disaster preparedness to alert them to close roadways and evacuate.

6. **How does your institution disseminate their climate information? (what communication channels are used, how is it distributed)?**

The meteorological services use several channels of communication to disseminate public information such as website postings, email listings, and in person meetings. Individuals and institutions can request data and information by phone or email. Emails are currently sent out to several list serves but administration hopes to create a new platform for more consistent communication as currently this method is sporadic.

Water Resource Authority also generates early warning flood system funded by PPCR. Messages are sent to emergency management and disaster preparedness to alert them to close down roadways and evacuate.

7. To whom is the information distributed?

National Meteorological Service disseminates information to Agriculture sector, Water Resource Authority, and several Research Institutions monthly. They also provide data and info to the Health Sector and Individuals upon request. They issue alerts to several areas predominantly working with the agriculture sector. These alerts are sent via phone and are also radio broadcasted. Met services are working to formalize these communication platforms to better incorporate populations that are illiterate and/or do not own a cellular device.

Climate bulletins are provided via email and are sent to the agriculture sector and to some individual farmers, Water Resource Authority and several other research institutions. Monthly emails are sent out with one bulletin, rainfall summary and forecast for upcoming three months however the health sector is not a part of these. Not all products are received by all parties. It is noted that the climate sector would like to have more contact with the health sector as currently data is sent only upon request.

8. Is there a standardized database? (Y/N)

YES there is a standardized database (WMO) but National Meteorological Services are currently not using it because of security issues. The hope is to have products developed from the data so they are working on that now.

a. What does standardization entail? Is it conforming to an international standard, and which one?

National Meteorological Service data conforms to WMO international standards. Manual gages data is pulled annually, real-time data is available for some but not all are real time. So usually MOH records down monthly automatic data sets. For manual they have observers that have to pull the data. They note that as for the health sectors it would be great to have real-time data. Financial support and communication will be important to have automatic stations become real-time and wifi infrastructure will need to be developed.

9. What is the spatial and temporal scale of meteorological data?

10. How many stations do you report from? (see details at the annexed excel file)

209 Stations 85 Automatic, with a goal of approximately 200 automatic stations.

11. What climate/weather variables are measured? What kind of measurements of thresholds, or periodic metrics? What other meteorological/ hydrological indices are measured? (Repeat for each station/source listed above, if different)

VARIABLE	(Y/N)	FREQUENCY	UNITS/TYPE
Temperature	Y	Every hour and daily mean	Celsius degree
Precipitation	Y	-----	Millimeter of rainfall
# Tropical nights	Y		Nights
Drought indices – e.g. Standardized Precipitation Index (SPI)	Y		standard deviation from the long-term mean
Daily Temperature Range	Y	Daily	Celsius degree
# Wet days above a threshold	Y	Daily	Days
Relative Humidity (RH)	Y	Every hour	Percentage
Other: Wind (force and direction)	Y	Every hour	Knot

NOTES



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