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Report:

CARIBBEAN SCIENCE SYMPOSIUM ON WATER

March 23rd – 25th, 2021

"Building Resilience in the Regional Water Sector to Address Climatological and Hydrological Risks and Threats"

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Day 1 – Global Water Partnership-Caribbean (GWP-C)
Caribbean Science Symposium on Water

Summary of Opening Remarks

The Symposium was opened by the Global Water Partnership-Caribbean's (GWP-C) Regional Coordinator, Ms. Simone Lewis. In her remarks, she acknowledged that the origins of the symposium dated back as far as 2019. She shared that it was a reflection of analysis of multiple conferences previously held in the region, from which a gap between science and policy was clear. GWP-C therefore took the initiative in helping to bridge that gap, with a view to promoting more effective cooperation. To achieve this, GWP-C has secured the participation of major stakeholders in the water sector in this event; in recognition that water is an overarching thematic area which impacts development in all other sectors. GWP-C has been exploring opportunities to strengthen collaboration between science and policy by using a participatory approach and is the first of the GWP territories to promote this cross fertilisation of initiatives, innovation and best practices of Integrated Water Resources Management (IWRM). Ms. Lewis expressed her desire for the 3-day symposium to deliver on content, which would leave participants more informed about research and ongoing initiatives in the region, leaving them better equipped to act where needed.

Mr. Trevor Thompson, Global Water Partnership (GWP) Chair of Regional Chairs and Chair of GWP-C, also welcomed participants and expressed a heartened appreciation for seeing the vision of the symposium become a reality. GWP-C, its parent organisation GWP in Stockholm and members of the GWP-C Technical Committee (TEC), were commended for their efforts and described as "very committed individuals who worked tirelessly." Since we live in small island developing states, with small populations, we often do not feel credited and acknowledged for the actions we take. The Caribbean has similar challenges with respect to the provision of safe drinking water and other water security issues. The region has been dealing with these issues for a while now, as is evident from the norms regarding rainwater harvesting for various purposes.

This GWP-C symposium will expose participants to new and innovative technologies that the Caribbean can be proud of. This first symposium is only the beginning; the time has come for the Caribbean to combine its ideas, innovations, and best practices from various stakeholders at various levels. The mandate of GWP-C is to ensure the Caribbean is water-secure. It has been assisting through the adoption of various national water policies and encouraging the youth to participate in different fora. We will collaborate with various regional institutional partners such as the Organisation of Eastern Caribbean States (OECS) and the Caribbean Community Climate Change Centre (5Cs), to ensure that the outputs of this symposium are presented to policy makers across the region. To achieve the goals of Sustainable Development Goal 6, Clean Water and Sanitation for All, the youth must be encouraged to get involved at all levels.

Dr. Kevon Rhiney, Chair of the GWP-C TEC, acknowledged the considerable amount of time spent in meetings and deliberations to effectively plan the symposium. He noted the importance of water as an essential resource for multiple industries including tourism, agriculture, housing, and renewable energy. Even though this is a known fact, there are still multiple challenges faced.

To address the fundamental issues faced in the water sector, there needs to be closer relations between science and policy. This needs to take place in a timely manner, as to address vital issues and level the field of understanding on both sides.

Each day of the symposium is customised to maximise on engagement and impact. Many persons are responsible for this symposium becoming a reality, from the development of the concept note to reviewing of the scientific papers. However, special mention was made of Regional Coordinator, Ms. Simone Lewis and GWP-C Chair Mr. Trevor Thompson for their stewardship, and feedback in the process. Partners and sponsors (Caribbean WaterNet (Cap-Net), The Faculty of Food and Agriculture of The University of the West Indies (UWI) St. Augustine Campus, The Global Environment Facility-funded CReW+ Project and The Nature Conservancy (TNC) Caribbean) were also applauded for their contributions. The event will lay the foundation for many years of progress.

Feature Address from Senator the Honourable Simon Stiell, Minister responsible for Climate Resilience and the Environment – Grenada

The Honourable Minister Simon Stiell acknowledged his gratitude for the invitation to address the Symposium on the occasion. In identifying the significance of matters pertaining to water resources, Minister Stiell made recollection of the important role that the current Prime Minister of Grenada played in the launch of the GWP-C on the 9th of June 2004 in Tobago in his address, while making the call for decisive action. Minister Stiell stated "GWP-C is very dear to us and I congratulate you for hosting this symposium." Since 2004, GWP-C has grown from strength to strength, and is seen as a platform for partnership in the region, which enables the sharing of knowledge. Minster Stiell anticipated that the symposium would go beyond being categorised as 'just another forum for the submission and discussion of scientific and technical papers.' He expressed his belief that the event would become more of an arena for dialogue and interrogation of scientific posits from a policy perspective, as well as one, which incorporates the perspectives of young scientists and decision makers of tomorrow. Especially in these challenging times, an event such as this symbolises that there is an avenue for everyone to contribute.

Minister Stiell lauded the many strides that Caribbean countries have made in terms of access to safe and affordable water supplies, but cautioned that challenges still existed, such as climate change, drought, hurricanes, pollution, and sanitation. It is for this reason of vulnerability that water governance is imperative to progress.

In times such as these with COVID-19 having a huge impact on economies, such solutions are important. Funding for initiatives is available. However, these proposals must be bankable and well supported. Institutions such as the Green Climate Fund (GCF) want clear demonstrations of how climate change is driving change and how governments and other key institutions are looking to address the situation. To that extent, this symposium has a role to play in providing the science and evidence. This occasion will allow for greater scientific insight to the regional programmes, policies and action plans related to water management.

Minister Stiell gave the assurance that the Government of Grenada will continue to partner with GWP-C in helping to tackle these issues. In closing, Minister Stiell appealed to a sense of collaboration and collective resolve, in addressing issues of water management by applying the well-known phrase of "many hands make light work" and he thanked the GWP-C for facilitating such a process of regional cooperation.

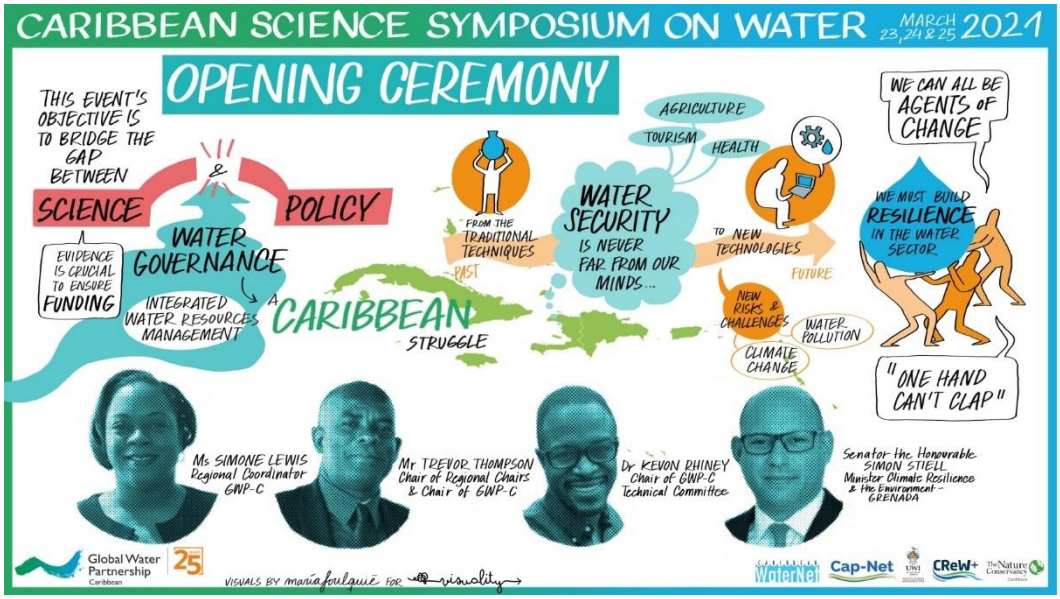

Figure 1 – A visual summary of the opening ceremony of the Caribbean Science Symposium on Water.

Keynote Presentation

Dr. Kevon Rhiney introduced the keynote presenter, Professor Michael Taylor, Dean of the Faculty of Science and Technology at The University of the West Indies (UWI) Mona Campus. Professor Taylor congratulated GWP-C for the range of participants in the symposium, making highlight of the involvement of the youth. In his opening comments, Professor Taylor established that his contribution focused on three (3) overarching takeaways from the IPCC's Special Report Global Warming of 1.5 ºC (1.5 Report).

Recalling the substantive intention of the Paris Agreement, Professor Taylor established the then target of 2 ºC to be the key indicator for monitoring progress of the activities associated with the agreement. He reminded participants that the Caribbean advocated strongly for 1.5 ºC. The 1.5 report is substantially in-depth and entails 5 chapters, 91 authors, representative analysis from 40 countries, 133 contributing authors, over 6,000 references and over 42,000 government and expert review comments.

TAKE NOTE!

The first takeaway from his presentation was titled '**Take Note**.' This takeaway captured a current snapshot of the advancement towards the agreement's targets, with a view to identifying progress or regressions regarding the outcomes. Professor Taylor acknowledged that we are already at 1 ºC and the associated events are proving to be a challenge. In this current state, on average we are witnessing 23 more hot days and nights per year than usual, summers starting earlier and lasting longer than usual. The increasing temperature is making rainfall more variable from year to year and in terms of the patterns associated with rainfall, less predictable. We are seeing longer dry spells and, on the occasion, greater floods.

Professor Taylor remarked "This is worrying as the patterns present unfamiliarity, unreliability and unpredictability. It is important since the Caribbean's existence is directly linked to Climate Change."

TAKE ACCOUNT!

In introducing his second takeaway, Professor Taylor highlighted the trends and implications of the lack of critical action, following the Paris Agreement. Given the enormous climatic deviations mentioned in the first takeaway, which do not appear to be dissipating, it is highly likely that we are on track to surpassing 2 degrees; this means the climate is outside of the bounds of anticipated change. He strengthened this argument by reflecting on the occurrences in 2017 where there were three (3) category 5 hurricanes, in 2019 where hurricane Dorian struck The Bahamas and in that same year where the alphabet naming system had exhausted the options for names. He opined that "when we are in the era of the unprecedented, the unprecedented, limits the attainment of the SDGs." Adding to the dilemma, is the fact that there is competition for limited resources to tackle the issues, exacerbating the overall demand for such resources.

TAKE ACTION!

The third and final takeaway from the 1.5 Report was in the form of a call to action, which stressed the need to take immediate steps to prohibit the rapid deterioration of environmental conditions owing to human-induced global warming and climate change. A livable tomorrow depends on what we do today. There is therefore a need to develop a strong mitigation agenda. As such, the water sector has a strong role to play and should have a loud voice in the environment for reversing the pace of advancing through to 2 degrees. We still must adapt if to reach 1.5 (across all sectors). The water sector must be at the table when others are drafting their adaptation plans.

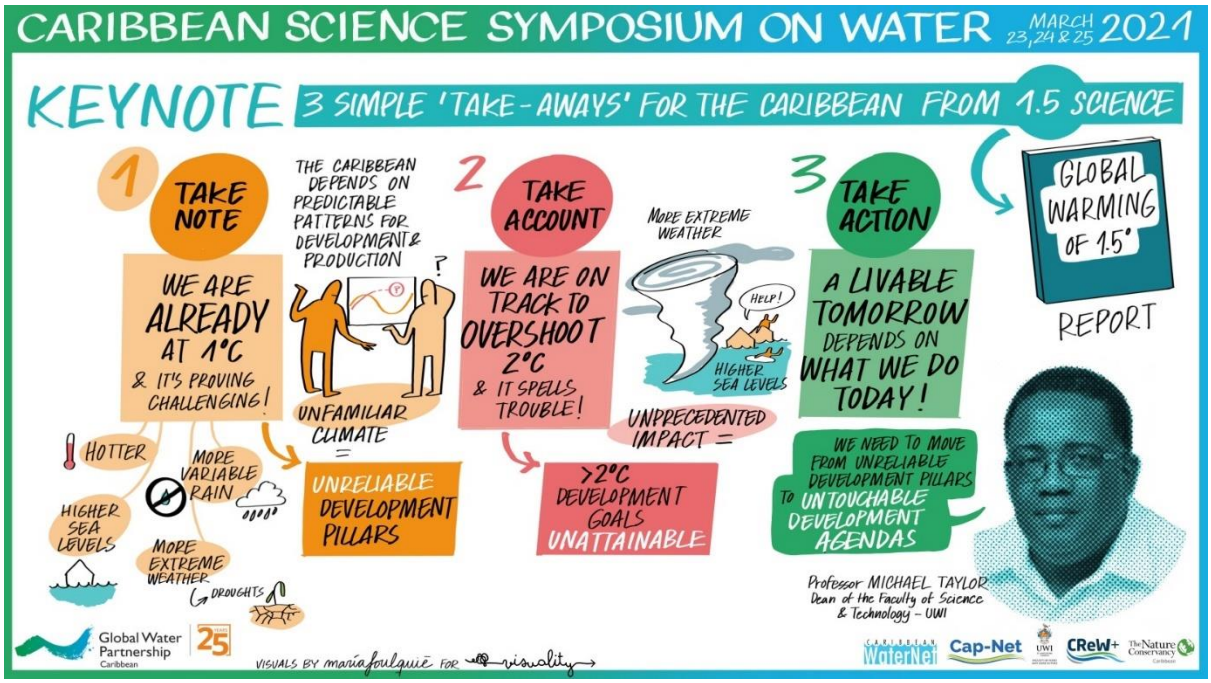

Figure 2 – A visual representation of the keynote presentation by Professor Michael Taylor, Dean of the Faculty of Science & Technology at The University of the West Indies (UWI) Mona Campus.

Paper Session 1 – Water Security and Climate Change

This part of the day's session was dedicated to the sharing and expert analysis based on three (3) distinctive research papers. Each presenter was allotted 20 minutes to address the core focal areas within the thematic area.

Paper 1 - Rapid Vulnerability Assessment for Adaptation Planning in the Caribbean Water Sector

In her presentation, Francesca Marino of HR Wallingford, reflected on the contemporary approach to rapid vulnerability assessments, while highlighting the dependency of the Caribbean water sectors on climate change, added to the vulnerabilities faced with limited financial resources and limited capacity. The aim of her research was geared towards identifying a common harmonised framework to understand how water sector vulnerability to climate change varies across the region. The approach was initiated through the accumulation and analysis of various Country Vulnerability Reports (CVPs).

In addition, participants were also introduced to the Integrated Water Resources Management Framework for Vulnerability used to generate country vulnerability profiles. This IWRM framework allowed for diagrammatical comparative analysis across various countries at the same time. This approach, though a step in the right direction and more comprehensive than some other testing methodologies, still faces some limitations. These relate to issues of data completeness across various sources, inadequate survey responses and the irrelevance of single scores in reflecting localised issues and risks.

Overall, this approach presents a rapid, simple, and transparent process that offers flexibility and applicability to other sectors. It is a useful tool for adaptation planning, and it promotes effective communication of the results.

Paper 2 – Caribbean Water Funds

Mr. Francisco Núñez introduced the fund as a financial mechanism to promote the preservation of the watershed and ecological services to produce water, while also preserving biodiversity. This type of fund utilises the profits generated from revenues from water users and reinvests those resources into preservation work. The Nature Conservancy (TNC) established a target of 40 water funds for Latin America and the Caribbean Region and in efforts to make adequate preparation for such an application, TNC created a committee to analyse the legal and financial framework of each country.

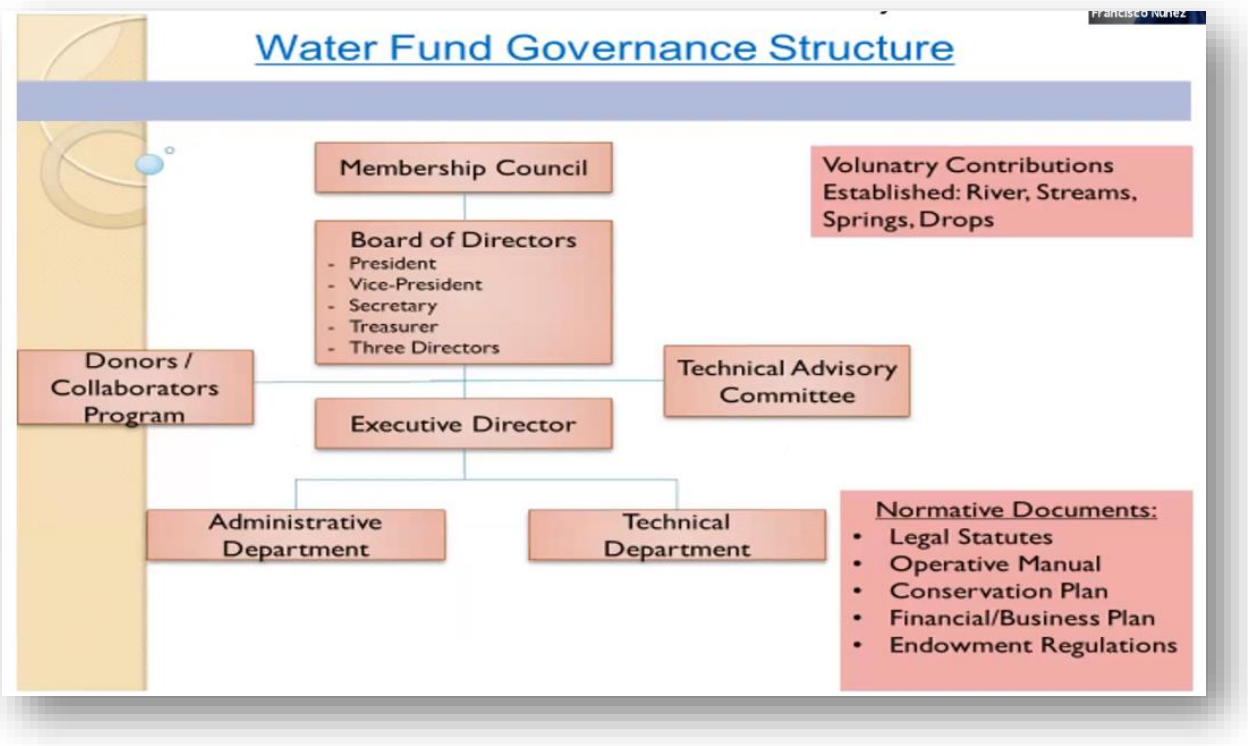

Figure 3 – Organisational Structure related to water fund.

A governance structure is also installed to provide overarching guidance to the water fund. This structure is depicted in Figure 3 and identifies the key stakeholders. Among these stakeholders are representations from Academia, Non-government Organisations, Government, and the Private Sector. NGOs have a very important role to play in the implementation aspect. The water fund membership strives to be as representative as possible, but it varies from country to country.

Within the region there has been some progress in countries such as Jamaica, to which notable milestones are attributed. These include:

- Completion of feasibility assessments and risk assessments.
- Completion of public education campaigns.
- Training of over 40 farmers in climate smart agriculture.

To date, the fund has managed to restore more than 1,000 hectares of land between Latin America and Jamaica. This achievement is expected to double within the next 5 years.

Paper 3 – Non-Revenue Water

Mr. Evan Cayetano reflected on the activities of the Inter-American Development Bank (IDB) and its structured methodology of research and the results regarding non-revenue water (NRW) affecting the Caribbean. He outlined the vision of IDB, which is assisting with assuring clean water and sanitation across Latin American and the Caribbean, in line with Sustainable Development Goal 6.

Mr. Cayetano referred to the Regional Strategic Action Plan for the Water Sector in the Caribbean (RSAP), noting it as a key overarching document for regional coordination and guidance on preparation and responses in the sector. He identified 5 key pillars of the RSAP, which are better depicted in Figure 4. These pillars inform decisions for water management and encompass all stakeholders' and interest groups. He noted the high level of NRW from the 4th pillar as his key focus of the presentation.

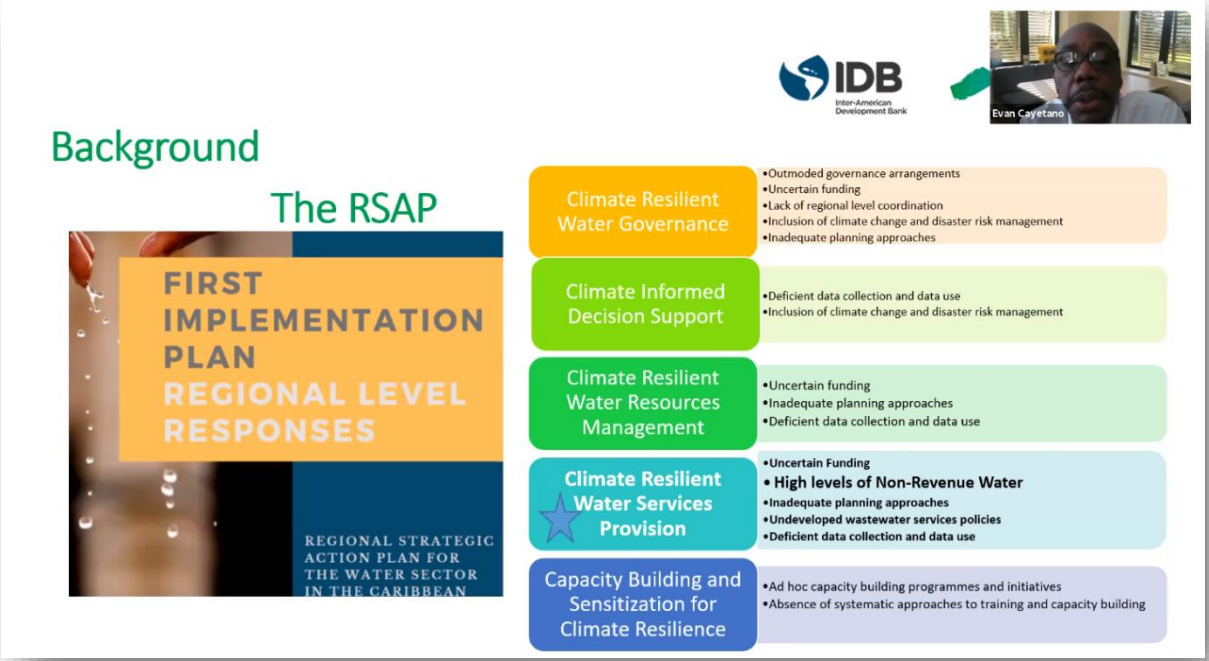

Figure 4 - Principles of the RSAP.

NRW was identified as the amount of water supplied by a utility into the distribution system and the amount of water billed to customers. He noted the main components of water losses being:

- Apparent Loss – these include faulty meters, data errors etc. these are losses that could be seen by the available data.
- Real losses – overflow of tanks, leakage from transmission main etc.

The international water association identifies issues relating to apparent loss to be a "low hanging fruit;" easily addressable and need not happen. The IDB has reviewed water utilities in all its representative countries in the Caribbean and they have prepared knowledge products and papers and benchmarking studies to look at the Caribbean utilities comparatively among each other. It is through these methodologies that the RSAP was developed with other development partners.

NRW is a global problem and represents 30% – 35% of losses for water utilities across the world. Within the Caribbean context, high inefficiency levels in the water sector are attributed to:

1. Aging equipment and pipes
2. Lack of comprehensive management strategy and asset register
3. Inadequate network maintenance design capacity
4. Theft
5. Unmetered consumption

These problems lead to multiple issues such as the deterioration of distribution networks, high physical losses and NRW levels, unreliable supplies, and low electromechanical efficiency of equipment. The findings and models developed also made recommendations which would result in increased billed amounts and reductions in real losses.

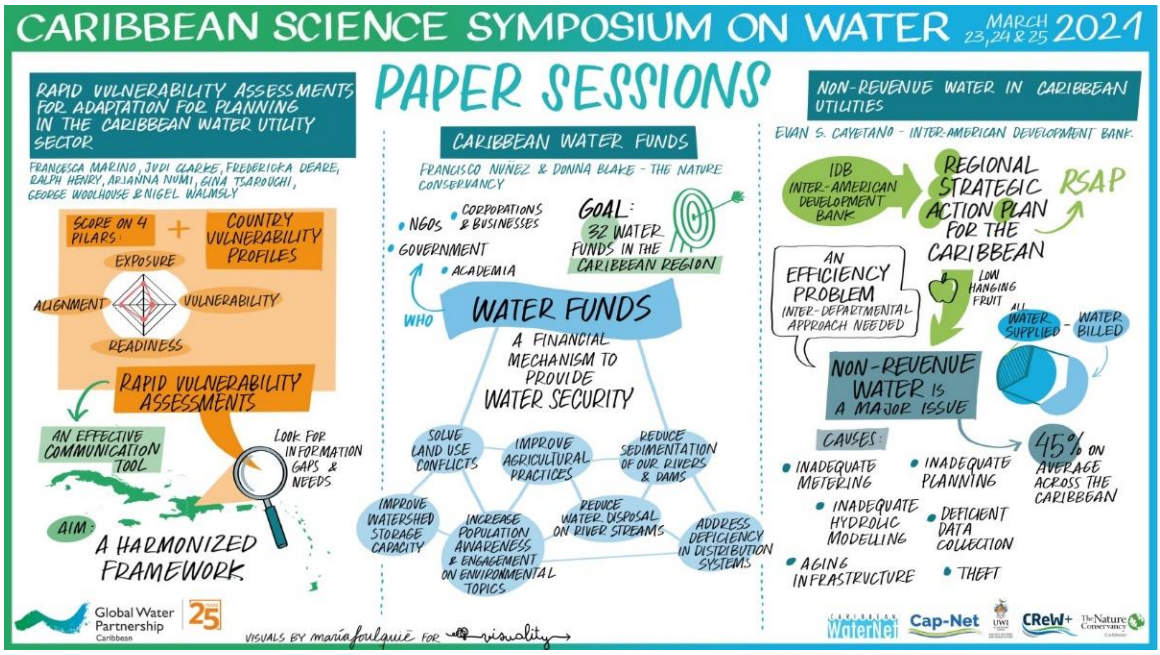

Figure 5 – A visual summary of paper session 1 of Day 1 of the Caribbean Science Symposium on Water.

Moderated Session: Bridging the Science-Policy Divide

The final session of day 1 was a panel discussion with inputs from reputable and relevant stakeholder institutions and comprised of the following panelists:

- Mr. Peter Clarke, Managing Director of the Water Resources Authority (Jamaica)
- Mrs. Wendy Harrison-Smith, Research and Development Manager of the National Water Commission (Jamaica)
- Mr. Barton Clarke, Executive Director of the Caribbean Agricultural Research and Development Institute
- Mr. Forrest Smartt, Climate Change Specialist of Inter-American Institute for Cooperation on Agriculture (Guyana)
- Mr. Christopher Corbin, Programme Officer at the UNEP Cartagena Convention Secretariat and Caribbean Environment Programme

The session commenced with the moderator, Mr. Trevor Thompson fielding the following questions to all participants in a digitally interactive manner:

1. **In one word, what is the first thing that comes to your mind when you hear the expression "Science-policy divide?"**

Figure 6 - Word cloud depicting the views of participants with regards to the Science-Policy divide.

2. **What do you think is urgently needed to bridge the "science-policy divide"?**

- Some serious Education and Awareness sessions for our politicians
- Can the agencies in LAC cooperate and share more for the greater development under SDG6
- Land and Water Information Systems For the Caribbean- Should be a focus going forward
- Why Caribbean countries fail to cooperate in the sharing of data and communicate on issues such as these that impact all of us
- Funding for scientific research to build the local and regional policy investments. This would lead to proper lessons learned with developing and utilizing local and regional personnel. This then and high time build expertise
- Anti-oppression training
- Insularity rather than policy or policy makers hamper our progress - scientific and economic - we need to work as One Caribbean as the same issues affect
- Engagement of ALL stakeholders
- The scientist needs to tell the politician what needs to happen the benefits that his Government and people can derived by carrying out such actions and the losses that will happen if those actions are not taken. They are not interested in what the science says because most of them do not understand what the science says.
- Unapologetically
- Address data sharing politics and hurdles between institutions
- Technical personnel need to be present in the decision-making processes
- Civil society organizations provide valuable information in the bridging of science and policy
- Importantly
- The absence of consultation with the civil society is a major hurdle in any type of policy making

- Target potential future policy makers early … the up-and-coming politicians … each Election Cycle presents an opportunity for sensitization and lobbying …
- What is the 'language' of politics? And
- Science must be communicated in economic terms given the focus of policy makers of positive impacts to economic development
- A framework for collaboration is needed
- Understanding of the type of information that is needed to make informed decision
- Is it just a 'divide' which requires bridging?
- better governance framework the brings in the science on par with economic and other national development indicators
- The engagement and involvement of academic youth and young scientists who offer timely
- Remove Ministerial discretion in legislation so that politicians cannot override evidence-based recommendation by technocrats.
- More scientific involvement that considers more stakeholder involvement that dictates policy and an agenda. There is not much local raw data that translates into relevant information and on top of that there are too many silos that restrict proper policy development as historical information both in the scientific context and the sustainability goals can attain. The disconnects are who are a part of the discussions to then affect the policies.
- Resources
- Need someone that can communicate the science to the policy makers in a language they can understand. Disseminate information based on the audience
- Scientists also need to understand political constraints guided by limited revenues
- Perhaps we need more scientists in parliaments?
- Harmonization of all aspects
- A framework for collaboration is needed
- It is a just a divide or also a 'conflict'?
- Willingness to make change based on evidence and not politics
- Good governance
- Collaboration
- Lack of trust and communication
- Sensitized politicians and informed electorate
- Patience
- Translation of science into easily understandable recommendations and actions
- Research
- Stakeholder engagement
- Training
- Education and Collaboration
- Effective communication and collaboration
- Communication
- Metrics
- Evidence
- Multi-stakeholder communication
- Truce
- Commitment
- Communication

The session then focused on generating feedback from the panelists regarding the subject matter of the Science-Policy divide. The first part of the session was dedicated to determining the various aspects of that dilemma and as such, the panelists identified core issues of:

- Ineffective communication and language barriers.
- Lack of education among policy makers that would enable them to understand the scientific context.

A range of views were expressed regarding the steps needed to be taken by scientists and technocrats to make life easier for policy makers. The panel identified numerous options such as:

- Transforming information into a format that policy makers could understand and exploiting all communication methodologies.
- Identifying and utilising the specific relationships that policy makers can understand; currently made difficult with inadequate explanations regarding the pathways and linkages to sustainable development.
- In some instances, scientists should be part of the policy making process.

The panelists also suggested moving towards a results-based management system, which would better compel policy makers to focus on the objective parameters of various cases and considerations. There were also calls to operate more collectively as a region, given the fact that the water scenarios faced by many of the countries in the region are very similar.

Mr. Thompson probed the ongoing experiences of the panelists to help identify initiatives currently being undertaken that could contribute to the closure of the science-policy gap. Panelists continued to offer solutions which included developing new skills to communicate and ensure that communication is not solely based on scientific delivery formats. Some organisations, such as IICA already factored in water considerations into their projects. They also hosted workshops to add awareness to science and technology in the water sector. Other organisations, such as the National Water Authority in Jamaica, also have a structured approach in which policy makers utilised much of the data incorporated in their platform, to make better informed decisions. The water fund, highlighted by The Nature Conservancy also depicted a template approach for cooperation in the scientific and policy making areas, toward a common goal. The panel also believed that technical expertise and those subscribing and practicing the science, should make a greater effort of making themselves more available to participate in various organisations. One participant also hinted at the implications of scientists being more directly involved by being actively involved in politics, as another alternative method to bridge the gap.

Mr. Thompson thanked the participants of the panel for their inputs.

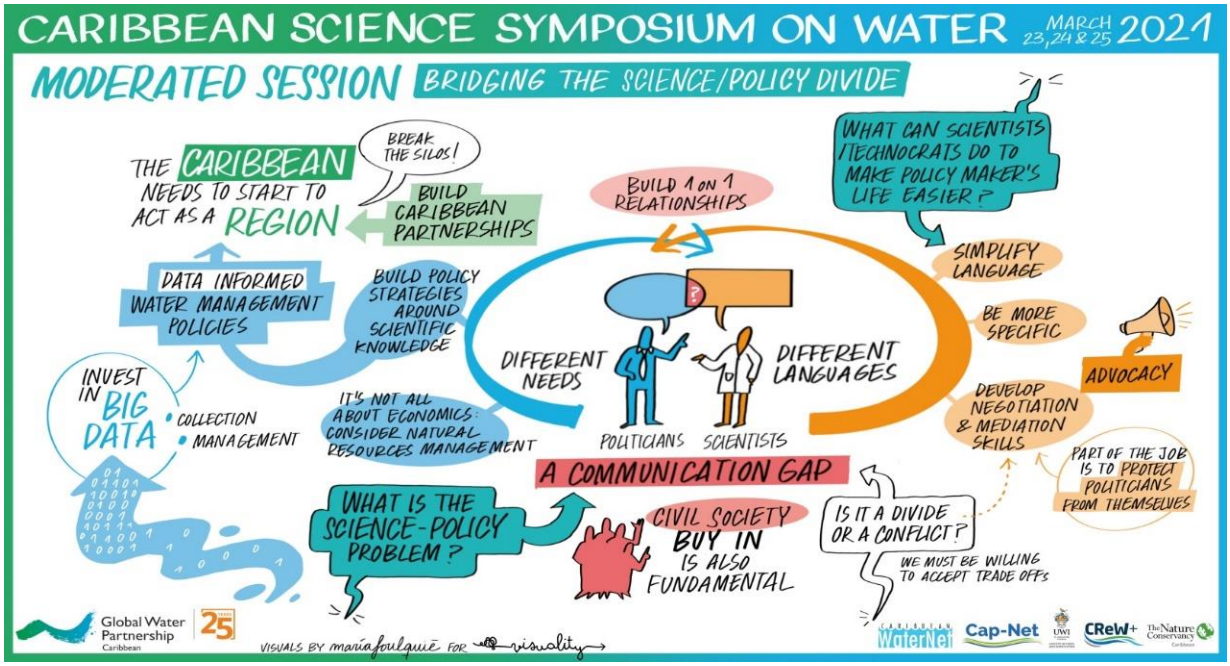

Figure 7 – A visual summary of the moderated session on bridging the science and policy divide in the water sector.

Closing Remarks

Dr. Paulette Bynoe described the session as interactive and interesting throughout the day. It has been very successful in providing background context and highlighting the importance of the selected theme for the symposium. She reflected on the other sections of the day's session, reiterating the key aspects of the keynote presentation, which embodied much of the key focus of the event. Dr. Bynoe encouraged participants to join the Symposium on Day 2, which would focus heavily on the youth.

Day 2 – Global Water Partnership-Caribbean (GWP-C)
Caribbean Science Symposium on Water

Summary of the Opening Remarks

The second day of the GWP-C Caribbean Science Symposium on Water consisted of a blended approach connecting the youth. Mr. Darío Soto-Abril, the Executive Secretary and Chief Executive Officer of the Global Water Partnership (GWP), welcomed day two and stated that his motivation for joining GWP is the hope that all individuals should be able to enjoy the benefits of water accessibility. The need for partnerships and networks was emphasised and served as a reminder that the reason for the symposium is to bring scientist, government, and practitioners together to discuss the various water challenges and solutions in the region and the world. Moreover, the idea of partnerships with universities and government is seen as a key to the success of water resource management. This is because we can benefit from the viewpoint of policy experts, which is evident from the hosting of a symposiums such as this to make a change when it comes to water.

Mr. Soto-Abril invited participants to take inspiration from the youth to lead to practicable solutions to the challenges we encounter. Moreover, there must be reflection on how our conversations, research, analysis, and conclusions can lead to concrete and practical solutions. This will have the effect of boosting water change for many years in the Caribbean and globally.

Through the launch of Integrated Water Resources Management (IWRM), it was highlighted that the aim of this initiative is to merge cross-cutting topics evolving globally, such as gender, youth involvement and climate change together to derive solutions that make us resilient to events that affect our water resources. The actions we are taking today are linked to our reality and an understanding of our realty is deemed important as the accessibility to water is linked to health, sanitation, and livelihood. Thus, greater importance is placed on solutions and policy to reflect our reality and we are better able to learn when facing our reality; there are benefits from conducting discussions and symposiums such as the GWP-C Science Symposium on Water.

To protect our water resources, it was emphasised that we need to be practical, and we must act. This can be done in discussing our learnings which are valuable and advocating for communities whose water resources are being impacted. Active involvement directs there is a need to move from research to a discussion of our learnings, to policy and then action because the community and region demand it. However, it is equally important that we move from the policy stage in the same way, away from research to action and in the move towards action the youth can contribute to achieving agenda 2030 and the Paris Agreement.

> *“ the actions we take to manage our water resources today is linked to our reality.”*

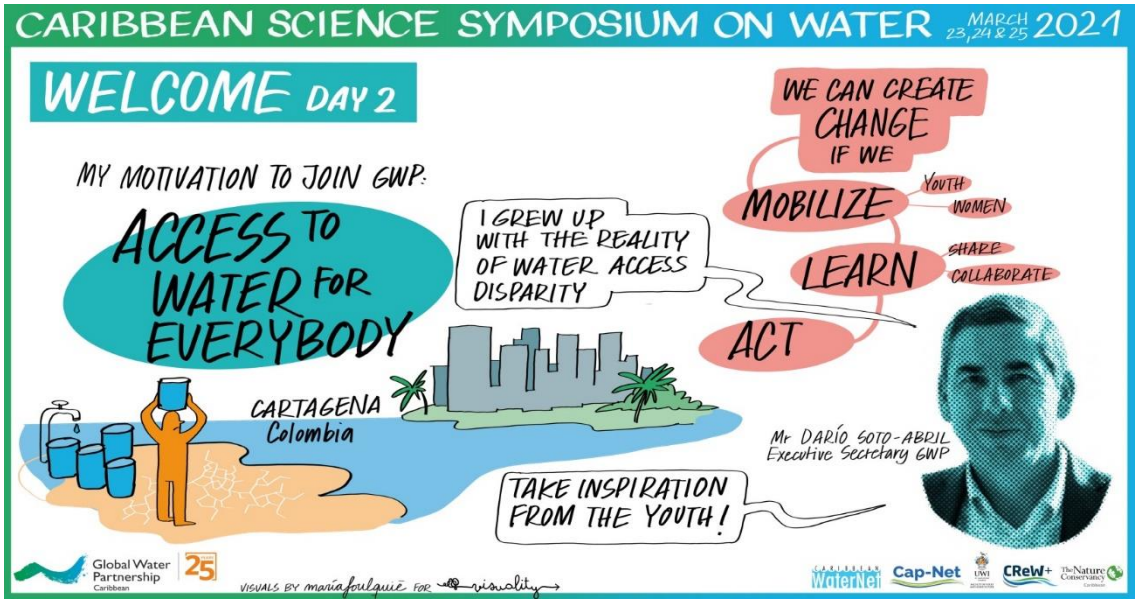

Figure 8 – A visual summary of the opening remarks of Dr. Darío Soto-Abril.

Memorabilia Presentation by Simone Lewis, GWP-C Regional Coordinator

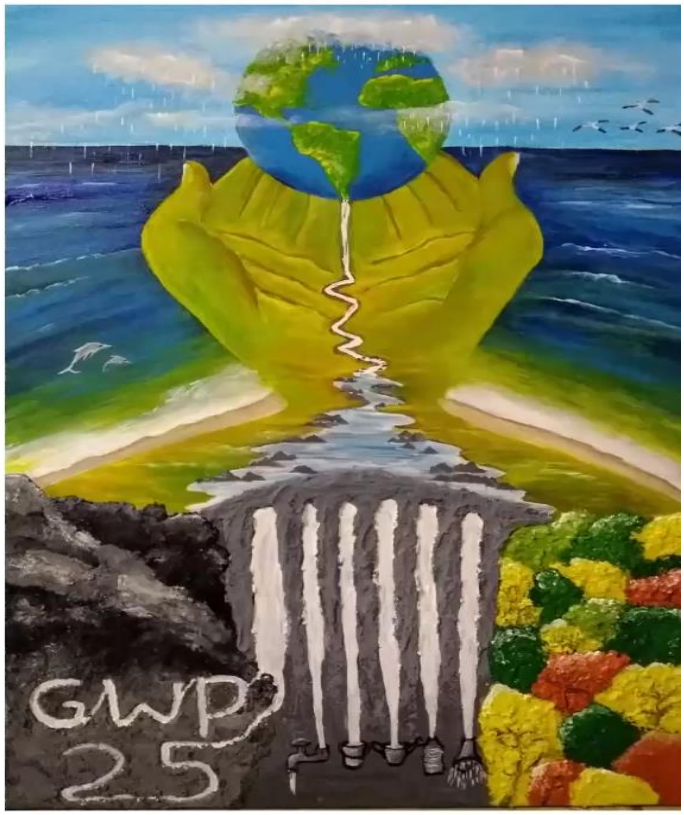

Figure 9 - GWP 25th Anniversary Memorabilia created by GWP-C.

In celebrating the existence of GWP for twenty-five (25) years, a painting was done by a Grenadian artist Mrs. Kwamina Brizan-Arnaud and presented by Ms. Simone Lewis, GWP-C Regional Coordinator. This was a way of recognising contributions that GWP has made globally and serves as a symbol of GWP-C's appreciation of the leadership that the GWP Organisation has given over the past seventeen (17) years, as GWP-C works to implement innovative water resources globally.

Keynote Presentation by Ms. Rianna Gonzales: GWP Youth Engagement Specialist

Ms. Rianna Gonzales acknowledged the partners and recognised speakers who contributed to the initiative of water security in the Caribbean. The presentation highlighted the importance of youth and the need for their involvement in confronting challenges on water security. Accordingly, participants were invited to consider where youth fit among the two (2) spectrums of science and policy, as it relates to water security. It was observed that solutions are available to confront the region's water challenges but at the same time, we continue to suffer and remain susceptible to threats of water security. This was attributed to the fact that policy makers are seeking simple one-off solutions instead of practical ones and underestimating the time and resources needed to collect data thoroughly and responsibly to develop practical recommendations. Additionally, underestimating the youth's ability to contribute to policy and innovation is the reason for current challenges.

In the Caribbean, we continue to be impacted by climate change. Moreover, we are at a critical juncture where our development agendas are to serve as a guide towards a sustainable future as they are based on information and the predictive seasonality of the environment but can no longer be relied upon. Youth are influencers to policy change and there is a need to leverage their voice, as the voice of the community, country, and region. Ms. Gonzales articulated the need for evidence-based policies that are supported by relevant Caribbean research. Equally, the need for policy and research should align with society's needs and must be known and accepted by communities to be applied and crafted into an innovative solution. Therefore, there is a growing importance for promoting meaningful participation in science policy and decision-making and an active participation from the youth should be considered to successfully achieve these policies. The youth of the region were encouraged to use the research available or stake the initiative to start their own research to build an evidence base for their cause in relation to water security with relevant messages and make it available to decision-makers.

Ms. Gonzales discussed many challenges in youth being heard but also emphasised there are several mechanisms for youth to get their message to decision-makers. The various institutional frameworks were identified as the mechanisms that should be utilised to bring the voice of the youth forward. These include:

- The Lisbon Declaration on Youth Policies and Programmes
- The World Programme on Action for Youth
- Commonwealth Programme for Action on Youth Empowerment
- CARICOM's Youth Development Action Plan

These frameworks are valuable and have guided and formalised Caribbean youth policies and highlight the greater participation for youth in global issues and policy. Therefore, it was recognised that the framework for participation exists and only needs to be implemented and resources allocated.

Youth have unique communication skills that transcend across all generations to engage civil and political discussions. Moreover, youth are recognised as having a unique ability to transform the complexity of the science and transform the implications into creative, fun, and palatable information. Hence, for policy and research to be understood and known to society, youth can act as academic hybrids and communicators of water issues and solutions. This means they play a critical role in contextualising knowledge obtained to inform action to solve water issues in their communities.

Although youth bring clarity and fresh perspectives to the issues of water security and can help bridge the gap between diverse groups and political engagement, the ability of youth is not only left in their skill to inform and communicate through social media. The abilities of youth also exist in their creative innovations, entrepreneurship and technology that provide solutions to our water challenges in the region. The innovations assist in the accessibility of water in rural communities, and this is evident in projects such as application technologies, improvement of sanitation and use of nature-based solutions to improve water quality and mitigate flooding.

However, Ms. Gonzales noted the full potential of these skills are dependent on strong knowledgeable youth and access to training, joint learning, and relevant capacity building initiatives to build their skills are necessary to become agents of change of water policy processes in water management. Additionally, it was voiced that the GWP creates opportunities for joint learning and capacity building by positioning themselves in water policy processes to advance good water management and to build innovative approaches.

Ms. Gonzales concluded by highlighting the introduction of a special pilot programme named the Youth Water Academy, for youth to realise their potential in the water community to become influencers and leaders in water resources management. Additionally, encouragement for youth to be involved was given and it was reiterated that youth play an essential role in the process of policy and solutions through their unique abilities. Ms. Gonzales shared key points she learned in her journey and advised others:

- To engage and empower youth as this will ultimately contribute to bridging the gap between science and policy.
- To be consistent in what is done, show people who you are, what you do and build trust.
- To know the game they are playing by learning from others and gaining insight, know the rules and make and build partnerships.
- Be credible – do research, read, and keep up-to-date with what is going on regionally and internationally.
- Be bold and brave.
- Urge policymakers to take up the challenge and make a pathway for young people to be involved and contribute to policy processes and listen to what they have to say and actively engage with them.

"the pandemic should not diminish the gravity of hydro hazards…human life is paramount, but livelihoods must also be safeguarded"

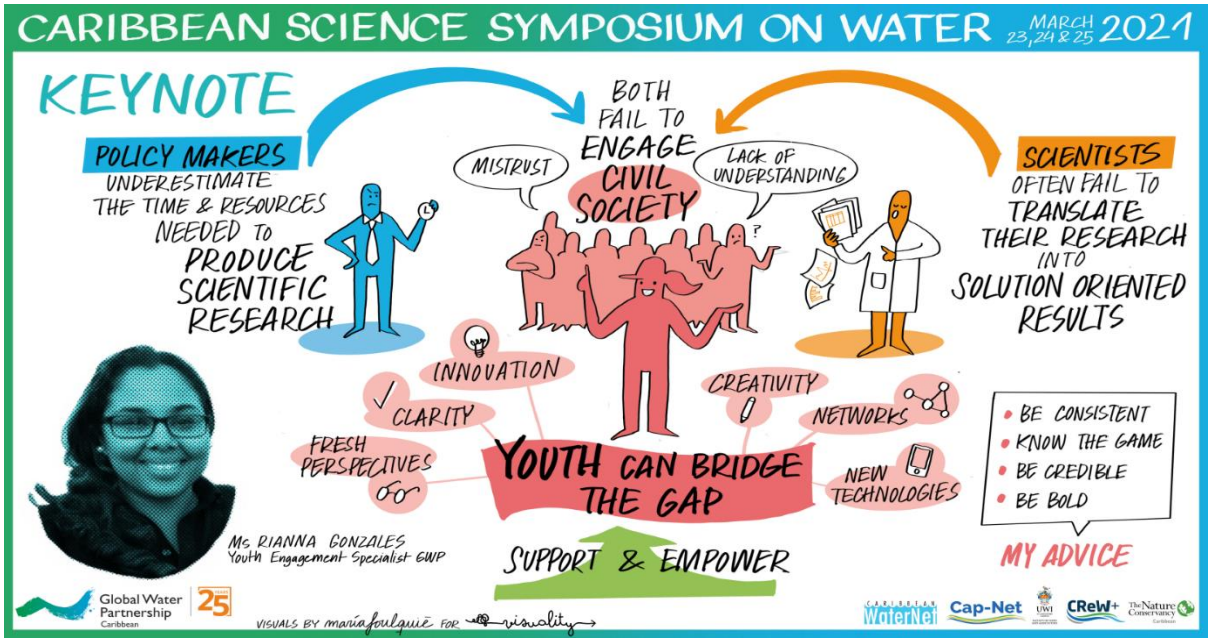

Figure 10 – A visual summary of the keynote presentation by Ms. Rianna Gonzales.

Young Caribbean Water Entrepreneurs: Shark Tank Session & Round Table Discussion on Youth and Gender

Mr. Carlinton Burell, the Chief Executive Officer of the Caribbean Climate Innovation Center (CCIC) moderated this session. He indicated this segment sought to highlight the innovative ideas of youth and their entrepreneurship. This was seen through the GWP-C Young Caribbean Water Entrepreneurs Shark Tank competition which was launched in 2019 and provides a unique opportunity for Caribbean youth between the ages of 18- 34 years to pitch innovative water ideas and technologies to support better management of water resources in the community, and region. The winners received four thousand (4,000) euros funding to support advancement of their winning water project. The themes of focus were water and climate, water and agriculture water and health, water and energy and water and tourism.
The 2019 and 2020 GWP-C Shark Tank winners were introduced, where their past entry pitches in the competition were shown.

WaterPee: A product of PreeLab Ltd. – Mr. Yekini Wallen-Bryan

This product was developed by Mr. Yekini Wallen-Bryan who is the 2019 winner of the Shark Tank Competition and the founder of PreeLab Ltd. PreeLab Ltd. is a company that specialises in remote monitoring, automation and control products for commercial distribution and provides customised products for industrial and agricultural purposes to commercial clients.

Mr. Wallen-Bryan's innovation began with the development of PowerPree, an electrical monitor, that allowed customers to monitor and control their electrical supply from anywhere in the world. This was essential in helping manage resources where there is a high cost attached to energy in the Caribbean and the world.

A similar product for water was developed due to overwhelming requests from customers of PowerPree. Moreover, individuals were faced with inexplicable water bills, unaware of tank levels resulting in no access to water, leaks on properties causing water damage and other water management issues. The experience from PowerPree was used to build a prototype for water called WaterPree to measure water levels and the amount of water flowing to a property, with the ability to control water supply from a website or an app. He further explained that WaterPree is a product that can be installed today, which consists of a flow sensor and motorised valve which has been tested and demonstrates core functionality. The device has the capability to open and close valves from a computer and can detect the slightest leaks. Moreover, he was able to monitor tank levels through a water tank sensor also developed by PreeLab Ltd.

For the future, Mr. Wallen-Bryan indicated a desire to incorporate the device with smart technology and smart homes to further its development. He thanked GWP-C who gave resources to cover development costs at a critical time and concluded by stating the product launches in June 2021, but pilots are available at a cost.

Figure 11 – A demonstration of the WaterPree System and Tank sensor by PreeLab Ltd.

A Constructive Farm Wetland – Mr. Ajani Jacobs

This innovative idea came from Mr. Ajani Jacobs, the GWP-C 2020 Shark Tank winner. The innovative project consisted of a constructive farm wetland to mitigate the impact of climate change caused by climate variability, which causes heavier and prolonged precipitation and stronger weather systems. The occurrence of these events, causes an increase in flood risk which results in soil erosion and disrupts crop production, impacting livelihoods.

The increase incidences of water flow due to floods on land, increases non-point source contaminants within the surface farm and the storm water run-off flow downstream and contaminates fresh water sources, which support live farm and resources which create opportunities for activities.

Mr. Jacobs stated the constructive farm wetland is like the farm wetland and uses natural processes to treat contaminated water. Moreover, it acts as a natural sponge to hold water to allow it to slowly infiltrate into ground water sources or to release into nearby water bodies.

The benefit of this innovation is it works with, instead of against the environment and offers a green sustainable solution. However, there must be an environmental site investigation or assessment, which informs the constructive farm wetland design, to allow the final stage of construction and implementation of the wetland. As a result, this benefits residents and communities near watersheds and can generate revenue. He emphasised this can enhance landscape and biodiversity and he will be seeking to partner with the National Environment and Planning Agency, as their mandate involves protecting and ensuring the sustainability of landscape and biodiversity.

Mr. Jacobs concluded by giving a progress update where he shared his partnership with the Jamaica Climate Change Youth Council and the finalisation of a proposal for stakeholder engagement. This partnership is important due to their association with the Jamaica Climate Change Advisory Board and their aim is to raise climate change awareness amongst youth. Moreover, the project will enable the council to have a substantial infrastructural initiative, where they seek to impact climate change and have a sustainable solution.

The formation of a steering committee was announced, which will ensure the implementation, conceptualisation, and maintenance of the project. The participants in the committee consist of individuals from the community, environmentalists, engineers, and ecologists to manage the stages of implementation and to ensure sustainability at different stages and cater to needs of community and project. There is a hope for interaction with stakeholders. The proposal is currently being reviewed. The aim of the review is to ensure each specialty can advise of a comprehensive and robust proposal to garner support from different stakeholders that will be engaged. This will be completed by the end of March. When the proposal is finalised, then it will be moved on to stakeholder engagement to get them on board with the project to see how best they can assist.

Q&A Young Caribbean Water Entrepreneurs

- In your specific countries what is being done by the youth to tackle water issues?
- Really exciting Yekini to hear your plans and thoughts.
- What further plans do you have to grow your business?
- Great to be able to support youths with fulfilling their visions. Are you thinking of passing on your expertise to other young people like yourself.?
- There are about 5 private water providers in Jamaica: e.g., Cancara
- Great to see young water innovators!
- What is the cost?
- Great work!!!
- Excellent innovation!!!
- Has Yekini interacted with NWC or other private water providers in Jamaica?
- Yekini when did you say WaterPree will be launched?

In the question-and-answer segment Yekini expressed that there has been no serious conversation with NWC or private water providers in Jamaica, but it is something he is planning to do. He also stated that WaterPree will be launched in June 2021 but there are pilot sales at a cost. As it relates to cost, it was stated this will vary depending on what you want and the set-up of the individual's property. When asked on whether there were any further plans to grow his business, he said yes but the focus was to get as much of the product out there first to receive feedback on how it responds and to build relationships with customers. He also expressed that he is willing to pass on expertise if WaterPree is sustainable in the long-term.

Round Table Discussion on Youth & Gender

This session was facilitated again by Mr. Carlinton Burrell who introduced the panel. The panel included the following:

- Lauren Arendse – Water Youth Network (WYN)
- Kendell Vincent – Board member of the Caribbean Regional Youth Council
- Luciana Raquel Verategui Moncada – Oceans Voice
- Adelin Pierre – Executive Director at the Caribbean Youth Environment Network (CYEN)
- Jamilla Sealy – Assistant Project Coordinator in the Ministry of Environment and National Beautification, member of the Caribbean Youth Environment Network (CYEN) and GWP (global) Steering Committee Member (holding the first-ever youth seat)

The focus of the discussion was for youth as leaders to give a perspective of the challenges and issues experienced in having an influence in water management. The discussion began with a question to the panel, which asked how young people can contribute to the advancement of the water sector in the Caribbean and what role do they see youth and gender playing in this advancement.

Lauren Ardense of the Water Youth Network began the discussion in answering this question. She expressed that youth hold novel ideas which is evident from their innovative projects and when given the opportunity, we can see a change in the water sector.

However, she stressed the need for youth to be properly included at all levels and through diversity from a gender perspective; we see creative engagement in the water sector. Luciana shared similar sentiments and reiterated that youth have the power to engage and build a community of different actors. Mr. Kendell Vincent of the Caribbean Regional Youth Council shared the view that youth are agents in promoting various agendas and they contribute through representative roles in organisations such as an ambassadorship, through creativity and the unique ability to engage diverse audiences.

The challenges hindering the involvement of youth and the skills needed to overcome these challenges in the Caribbean were also examined. Ms. Sealy indicated that youth are usually not invited to be involved at these levels of discussions. This is attributed to the notion that many believe it is a politician's job or someone with higher ranks. However, with the GWP-C Symposium on Water a trend away from this belief is observed and youth are becoming more involved in these kinds of fora. Additionally, youth need to know they should be involved and ought to reach out to government officials and policymakers to get involved or join an organisation that has the ability to lead to these places. Youth who are already in these places, can teach and engage others to link to contribute to policies in the sector.

The current generation must prepare for the development of the challenges to be inherited. Mr. Adelin Pierre of the Caribbean Youth Environment Network articulated the need to create a safe place where youth can learn from each other and the need to build and share tools together to create solutions. Moreover, a network to access information is necessary and we must work close with others such as governments and NGOs to share experiences and get more information on the problems we are facing in our communities.

The discussion was concluded where the panel expressed some of the opportunities youth in the Caribbean would like to have access to. Most persons expressed the need for financing and allocation of resources to allow for further engagement. Luciana expressed the lack of trust in the youth's approach in these issues but would like youth to have contributions along with decision-makers and governments in the water sector. The idea of advisors to provide guidance and knowledge which allow them to have a greater impact on strategies and solutions. Finally, Jamilla expressed there must be on-the-ground activities when engaging on issues of water, since all do not have access to social media. This means we must reach out to communities physically to understand the actual needs of the community, so the solutions fit their needs which ensures sustainability.

Q&A Round Table Youth and Gender:

- What are the opportunities for water research students to get a voice or a seat at the government table for policy making and legislature implementation?
- Do you think there is an opportunity for mentorship in the water sector?
- In Barbados for 3 or more years' residents in the north of the island have been concerned about contaminated water flowing from their taps, what is being done to rectify the issue?
- How do the youth get involved in the water sector? What advice do you have for someone that has just finished school and wants to get into these spaces?
- Many sources of information place emphasis on the difficulties faced by women and girls in Sub-Saharan Africa and South Asia in accessing and utilizing water resources. What is the extent of this in the Caribbean? And how do you perceive youth involvement in Water in the years leading up to 2030?
- What advice would you give youth who are interested in becoming more engaged and active in the water sector?
- What needs to change to give Young People a say in water governance at the national level (policy, legislation, stakeholder engagement etc.). How do you overcome the reaction that you do not have the experience to contribute?

To give youth a say in water governance at a national level, we need to have a youth policy. Luciana indicated that to overcome the no-experience-reaction: emphasis can be placed on the energy youth bring since it is about showing with action and not only work. Similarly, Lauren voiced youth can ask for an opportunity to be guided and assistance should be given for them to get experience. The opportunities for mentorship were asked and Kendell stated there are available opportunities. Thus, an individual can align with those who can help such as the Caribbean Youth Environment Network. Additionally, mentorship can be provided by connecting with other youth in similar positions that can connect you. Youth can get involved in the water sector by joining groups such as the Caribbean Youth Environment Network, joining clubs in school or lead an environmental group.

> *"be the change and create the change now, and we must work to build the capacity of our own to solve our problems."*

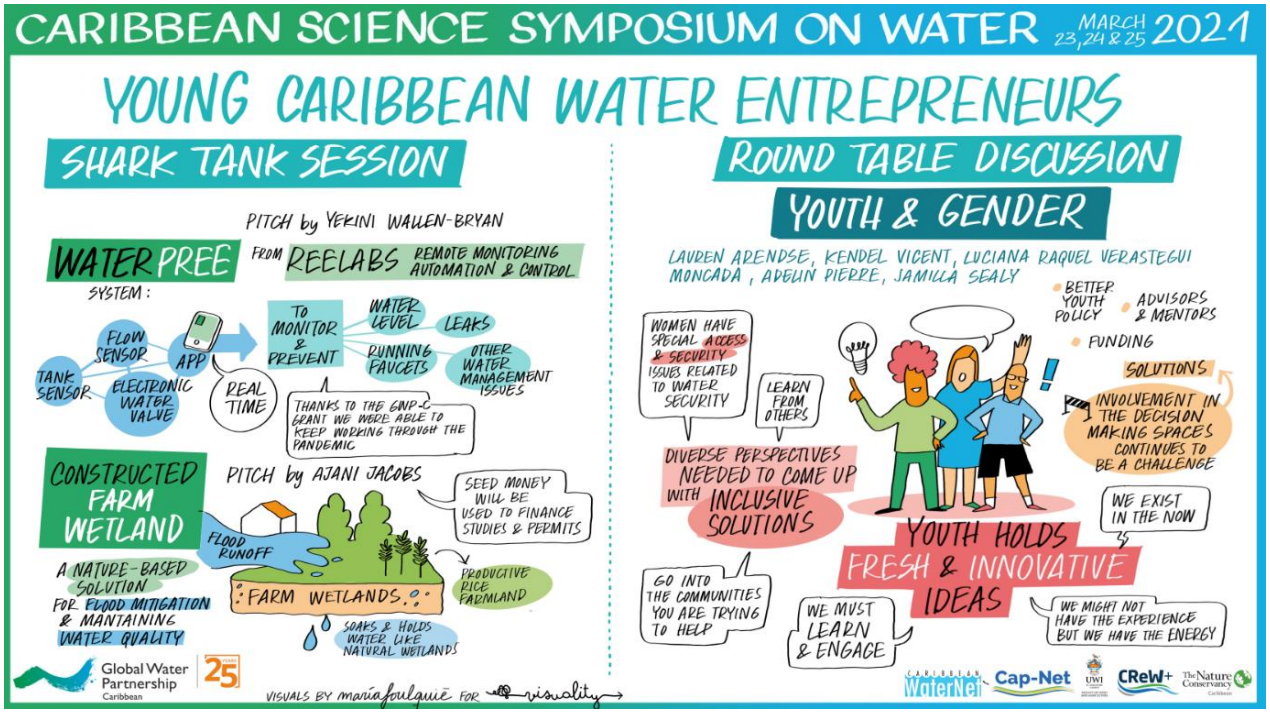

Figure 32 – A visual summary of the Shark Tank session and youth & gender round table discussion facilitated by Mr. Carlinton Burrell.

Paper Session 2: Water Security & Climate Change II

This session was facilitated by Dr. Adrian Cashman, GWP and GWP-C Technical Committee Member. The session involved two (2) presentations as discussed below.

Paper 1 – Groundwater recharge in Trinidad and Tobago

Marsha Allen is a 4th year PhD student at the University of Massachusetts Amherst. She explained that climate change causes part of earth to get wetter and some part dryer and a paper presented in 2018 by Dimitris Herrera showed analysis of climatic data in 1950s to 1980 and compared to the most recent drought, the pan Caribbean drought 2013-2016 and in his analysis, he showed most regions in Caribbean are experiencing much drier regional issues than compared to the areas experiencing more rainfalls.

Ms. Allen noted the percentage of dry land between the 1950s and after 2010, shows a high fraction of dry land in the Caribbean islands. Moreover, precipitation over the Caribbean islands has been decreasing steadily since the 1950s and the pan Caribbean drought represents the most recent evidence.

The Water and Sewage Authority (WASA) of Trinidad and Tobago has initiated research on the fractured runoff in Tobago to identify new locations to place pumping wells because of the increase demand for potable water. Hence, Ms. Allen explained the focus of her dissertation is to understand response systems to drought, using new methods to characterise ground water. She disclosed the study was started initially in 2014 in Tobago by Dr. Boutt. Several locations were broken into tiny subcategories to identify the pumping wells and surface expressions of fractions. A decision was made to calculate the recharge of each of the sub-bases and use an equation to calculate the precipitation of the runoff. Thus, they were called the groundwater recharge units.

In comparing the ground water recharge units to ground water extraction units, the extraction in these wells indicated that most of these catchments were producing 100-1000 % more water than was calculated in the recharge. Therefore, the source of a lot of access water remains unknown. As a result, Ms. Allen shared the research sought to find what is the source or sources of this excess water, the role of fractures in the transport and storage of groundwater and how does it react to climate scenarios.

It was revealed that the majority of Tobago is igneous and metamorphic grounds. Ms. Allen believes fractures and faults provide flow paths that crosscut geographical boundaries. Consequently, when we analyse precipitation and the rain falls, we expect it to go to high regions and flow to lower regions. However, these fractures are allowing ground water to crosscut, which is not normal to the flow. The flow paths facilitate groundwater mixing as precipitation percolates into rocks and the groundwater starts reflecting the chemistry of the ground type. Due to this, we can use chemistry to obtain the age of groundwater.

The research sought to obtain the age for the groundwater being tested in Tobago and environmental traces were used to calculate the age of groundwater. These traces dissolve at certain levels during precipitation and get into our water, which allows such testing. Tritium and sulfuric hexafluoride were used, and ten (10) wells were analysed. The sampling of tritium provides data which indicates when water would have entered the atmosphere originally. Sulfuric hexafluoride increases by 7 % in the atmosphere, each year since the 1950s and in measuring the base of the concentration, we can calculate the age of the water base on what date it came in.

In the north, the ages of the wells were very similar and between 18 - 20 years but as we move to the southern region the ages became a bit older on the island. The water was recorded at approximately 60 years from the tritium results. Ms. Allen expressed this is extremely novel for a small island, as most islands the age of water is 25 years old. Tritium analysis has been done in other islands such as Hawaii, Jamaica, Australia, and Puerto Rico. Tobago has the lowest mean and median, where their groundwater is generally older than all other islands. This may be because the fractured rock is able to store very old water.

In concluding, the use of these methods has provided tools for the sustainable use of groundwater, which can be used rigorously in severe drought scenarios. Moreover, it can be used to validate groundwater models and it can be used as a decision-making tool, if we know how much water we have and how much we need to purchase de-sanitation plants to compensate for the lack of potable water.

Paper 2 – Integrated Soil and Water Management

Mr. Ramgopaul Roop made a presentation on a case study of integrated soil and water management on smallholder farms in Trinidad. Mr. Roop observed that the impact of natural disasters and storms have an impact of over 50% during 1900 - 2018. Storm contributed to an impact of 65 % on the crops. The production losses due to natural disasters in the Caribbean, places the Caribbean at number three (3) for crop production losses expected due to these hazards. Mr. Roop acknowledged that Professor Michael Taylor recommends we need to take account, take note, and act.

It was observed that there has been note taking and action over years. Moreover, the annual rainfall increased from the 1960s to 1980s and then showed a subsequent decrease in the 1990s. In 1977 to 1978 there was El Niño and the drop in the sugar production. In Trinidad, this also coincided with the official closure of the sugar industry in Trinidad. This demonstrates the impact on the agriculture sector in Trinidad.

It was observed that there was an increase in dryness when dry and decrease in wetness when wet, in looking at the soil conditions. However, when we look at the water soil and crop production challenges, we can determine progression with agriculture. For example, without water in the dry seasons it is dry, there is heavy plague, cracking, difficulties in irrigation and crop failure. The challenge is the land distributed is government land and over 64,000 [acres] of such lands are distributed to farmers which consist of poor soil and production is low. The Cabinet Committee report indicated less than 20% of all the land distributed is under-cultivated. Thus, we are not on target in satisfying the sustainable development growth goal number 2.

The research question focused on whether the negative impact of climate variability or water variability can be mitigated by integrated soil and water management. The methodology of retrospective analysis was used and the key turning points were examined from 1994 -1997 and post 1997. Additionally, two (2) papers published were reviewed during 1994 and 1997 by the research division of the Ministry of Agriculture and there was an examination of the Agri-ecological practices of a farmer.

The location of the farm is Carlsen Field in Trinidad and former World War II air force base where the soil conditions there are very poor. The intervention to address the water challenge was the construction of the by-pass pond with a holding capacity of about 10000 m^3 of water. The bypass pond was constructed where there was an existing water course. Additionally, the pond was constructed more than ten (10) feet deep and well-lined to reduce seepage. Harvested water was recycled in the field by recycling all the water back into the irrigation pond and any excess water would empty into the environment.

A micro-low-pressure irrigation system was installed. A lay flat tubing was used, along with drip irrigation tubing. The soil challenges were the heavy presence of clay and high resistance. However, in resolving these challenges it was a situation of ameliorating the soil by ploughing, chiselling and soil amelioration. Additionally, the low-cost overburden quarry from the mountain was used in large quantities and was worked into the soil. On the contrary, agronomic practices were implemented such as an agroecology system of cropping patterns such as preservation of moisture and very little use of pesticides.

Mr. Roop examined the farm layout which consisted of a lean management concept, which laid out internal access roads so the farmer could drive his vehicle around the farm to do various types of farm operation. The lean concept is to minimise waste and minimise movement.

Based on results, the drip tubing increased the surface areas of the drain. It was observed that the drip tubing had more clogging than the sprinkling tap. However, the drip tubing had 60 % of efficiency and its overall impact, is that it increased efficiency and reduced erosion and run-off. The results of the tests showed an increase in pH from 1994 to 1995 from 3.8 to 6.8. and remains at 6.5 currently. A chemical change has also been observed in the soil. As it relates to agro-cropping there was an increase in yields and vegetables to 80 % and 40% for non-agronomic practices.

Mr. Roop concluded, by integrating soil and water management into their practice, farmers can mitigate the negative impact of climate change and develop resilient farms. Resolving, soil and water challenges are not a technical challenge but a long-term social process which can be resolved in implementing lean management concepts. It was recommended that there is a need for greater and more timely collaborations. Mostly importantly, we need to work on techniques to enhance the level of training for farmers so we can meet the sustainable goal to achieve food security and promote sustainability and improve nutrition.

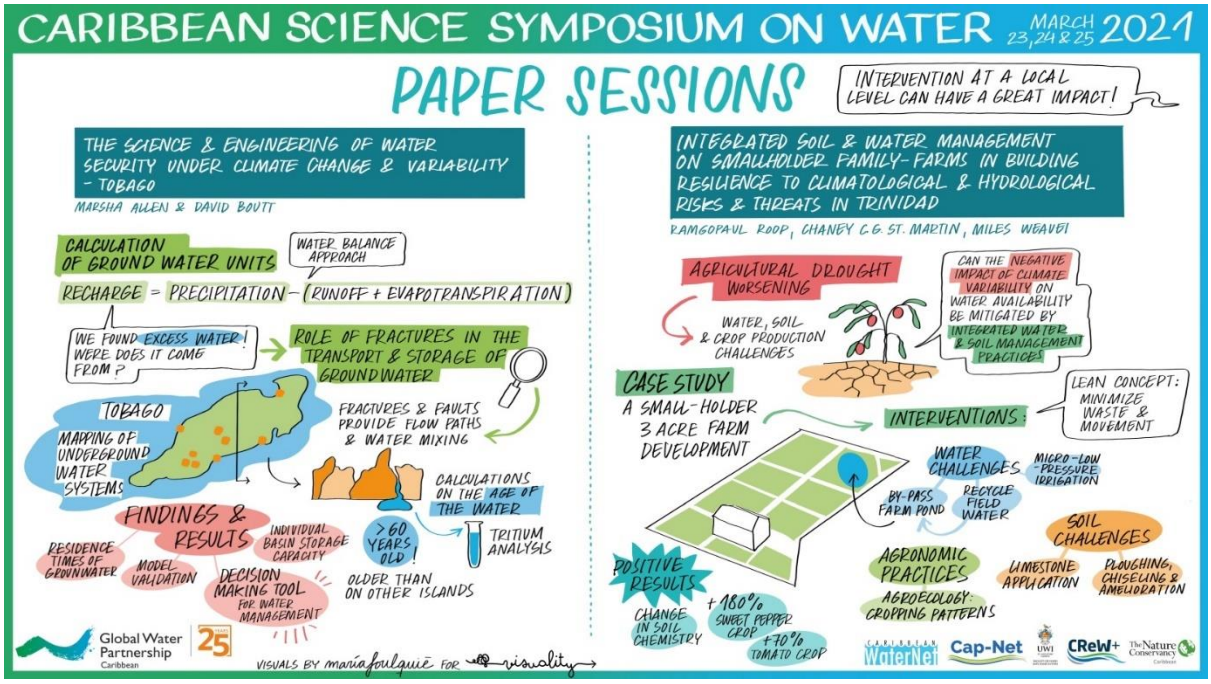

Figure 13 – A visual summary of the Paper Session 2 on Water Security and Climate Change.

Paper Session 3: Resilience

Paper 1 – Hydrological Modelling of Stream Flow and Water Demand in Jamaica

This session was facilitated by Dr. Karl Payne lecturer in water resources management at the Centre for Resource Management and Environmental Studies (CERMES). It was highlighted that the mantra today, seems to be re-building better in a sustainable and resilient way and the papers will focus on resilience in the water sector.

The first paper was presented by Ms. Melissa Curtis. This research focused on the hydrological modelling of stream flow and water demand in Jamaica using models Soil and Water Assessment Tool (SWAT) and Water Evaluation and Planning (WEAP) in the Rio Cobre basin.

The Rio Cobre basin is in the southeastern side of Jamaica and located within the Rio Cobre hydrological base. The Rio Cobre basin is sub-divided into hydrological units by the local Water Resource Authority. Moreover, it was highlighted that the northern section of the Rio Cobre basin comprises of the upper Rio Cobre and the lower part is in the southern section. Ms. Curtis focused her attention on the lower Rio Cobre given the upper Rio Cobre drains into one single outlet which flows into the lower Rio Cobre.

In analysis so far it has been observed, the upper Rio Cobre receives much more rainfall than the lower Rio Cobre and has an annual average rainfall which is higher than the lower sections of the Rio Cobre. In the southern section which includes the lower Rio Cobre, this extends into the Kingston basin which has a very low average rainfall when compared to the upper Rio Cobre. The Rio Cobre basin includes a basin in a north-eastern section, as well as a small section southwest of the upper Rio Cobre. Moreover, the limestone extends from the upper Rio Cobre into northern section of the lower Rio Cobre.

It was further explained that the upper Rio Cobre contributes to a section of Kingston's supply zone where the water supply in St. Ann's and Kingston highlight sections of the Rio Cobre. From analysis, it was determined that Rio Cobre can potentially supply more water to the Kingston basin. This is important as the other basins are showing sign of climate variability especially in drought periods. Hence, there is the potential to increase the supply by the Rio Cobre basin and this area can be extended.

Therefore, the research sought to investigate the demand and supply for the upper Rio Cobre and its ability to offset the water challenges faced in Kingston and other areas. Ms. Curtis, noted that with her research, if sustainable development goal 6 is achieved, it will have the effect of assisting in the achievement of other goals relating to society and economy.

Soil and Water Assessment Tool was used to predict the impact of the management of water in addition to the Water Evaluation and Planning model. The results as it relates to the SWAT model, in Rio Cobre Spanish Town water travels furthest downstream in comparison to the others within the basin. The Indian river shows lowest flow. The SWAT results were analysed using a three-month cycle flow for major territories and the main channel of the Rio Cobre. Ms. Curtis disclosed agriculture has the highest demand where upper Rio Cobre is located and is satisfied by stream flow. Moreover, potable, and commercial water demand is highest for the upper Rio Cobre and the reason for this is the lower Rio Cobre consists of a significant amount of residential area.

It was concluded, that the WEAP model can be revised every five (5) years to achieve demand and supply trends. Furthermore, the WEAP and SWAT model can be used for decision-making, for policy and planning development. It provides a useful methodology for a comprehensive policy development framework for the upper and lower Rio Cobre. Ms. Curtis advised that these models can also be utilised to examine other basins with the same technique and for an island wide examination of the impact of climate variability on water resource management.

Paper 2 - Identification of Risk in Water Supply Infrastructure and Strategies to increase Resilience

Mr. Yoany Sánchez Cruz presented on the identification of risks in water supply infrastructure and strategies to increase resilience.

The importance for Caribbean territories to transition towards water resource management for sustainability and resilience was emphasised. The crisis of water was identified as a global risk and there is a social impact of water increase if not managed. Moreover, the importance of having a plan for facing climate change is important. Mr. Cruz highlighted one of the biggest contributions to risk preventions in Cuba are hazard studies and meteorological vigilance tools which constitute a key part in risk management.

These include:

- To provide a solution as general objectives to create a methodology for the identification of risks associated with the piping of water of supply systems.
- To identify the hazards associated with the piping of water in supply systems.
- To propose the methodological devices for the identification and risk associated with the piping of water in supply systems.
- Assessment of risk in the main piping system of water management companies in Cuba.

In conjunction with the technological University of Havana, a pilot project is being developed to achieve risk management in piping water drinking systems. The centre of Havana's system has a large associated population to health, social and economic institutions. Moreover, they are exposed to diverse hazardous events that affect security of the water supply. Management in the urban cycle of water is important. Mr. Cruz shared that the framework of managing the risk is:

- Prevention – threats are assessed and identified to establish management priorities.
- Preparedness – investments are made, as well as to ensure resilience and sustainability.
- Response – an action plan is executed to maintain the drastic levels of water and sanitation survival during an event. Moreover, transparent communication channels are established for decision-makers and public in general.
- Recovery – risks are re-examined to dynamically maintain identification and assessment.

In concluding, he highlighted these four (4) stages deliver a productive risk management system in facilitating the safe use of water. Reference was also made to the three (3) important references in the international management of risk in the urban water cycle:

- PAHO – established guide on the use of drinking water systems in case of natural disaster which emphasises the vulnerabilities in case of extreme global events.
- WHO and IWA – They offer guidance and contribute to water safety planning. These assessment methods are explained based on risks assessed by expert criteria.
- UNICEF and GWP – provided tools for management of risks to climate change and the methodology is based on the principles of WASH and identifying and weighing the effects of climate change and of the possible degradation of water quality of contaminating agents.

These were highlighted as guides to building resilience and offer strategies to security and sustainability of water, as utilised in Cuba.

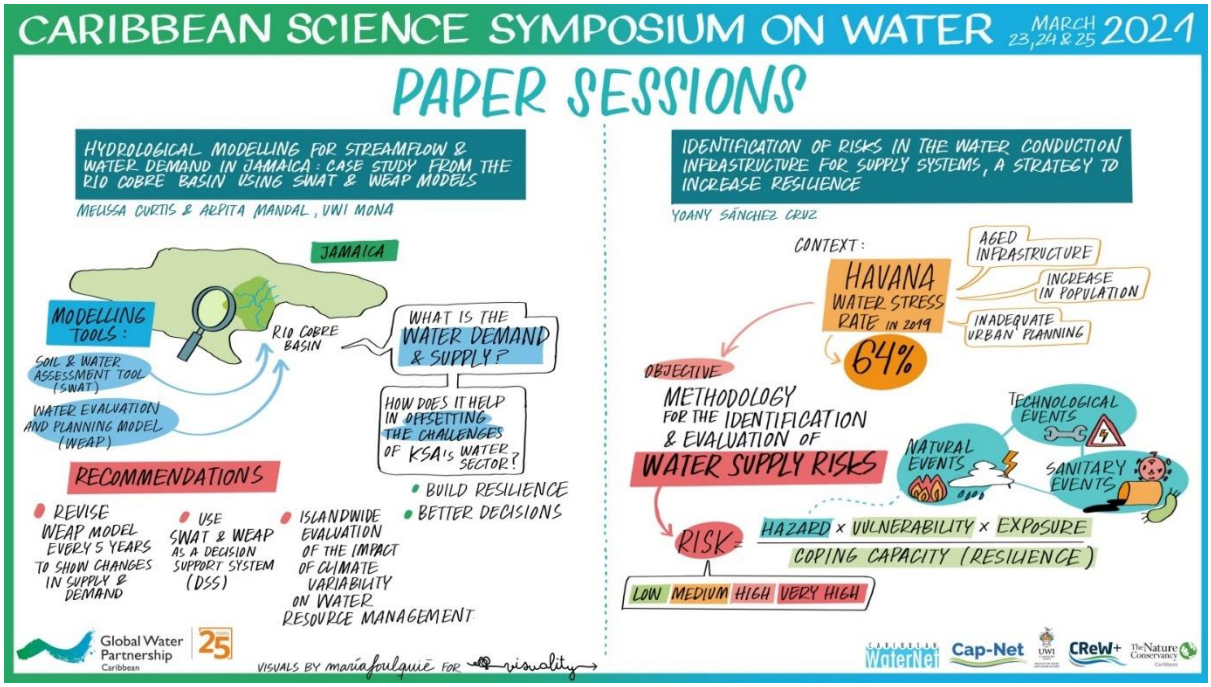

Figure 14 – A visual summary of paper session 3 on resilience in the water sector.

Closing Remarks

Dr. Ronald Roopnarine thanked the participants for an intriguing day and showing exuberance. He acknowledged the participation of youth and a desire to be involved in a policy-making process and the opportunity to make a difference. He observed that youth have a cognitive ability beyond what is possible. He also emphasised that technology has the potential to take us forward through modelling and techniques to obtain qualitative and quantitative data to inform decision-making. This is essential in moving towards water security, resilience, and climate smart initiatives across the Caribbean.

Day 3 – Global Water Partnership-Caribbean (GWP-C)
Caribbean Science Symposium on Water

Summary of the Opening Remarks

The third day of the Symposium was opened by the introduction of moderator Dr. Donneil Cain, a project development specialist at the Caribbean Community Climate Change Centre (CCCC). Dr. Cain welcomed Honourable Ministers of Government, GWP-C Chair and GWP Regional Chair of Chairs, Mr. Trevor Thompson, Regional Coordinator for GWP-C, GWP-C and GWP representatives, steering committee members, technical committee members, representatives of regional and international organisations and distinguished colleagues to day 3 of GWP-C's inaugural Caribbean Science Symposium on Water.

There was a reflection of the past two days of the symposium and the presentation by Professor Michael Taylor from The University of the West Indies (UWI) Mona Campus, which laid out the science behind climate change and its impact on the region. Dr. Cain emphasised from Professor Taylor's presentation, which focused the need for action in the water sector and building resilience. Further, Dr. Cain articulated it is indeed time for action because of the cross-cutting nature of water and a need to build resilience in the water sector. Dr. Cain recognised the symposium as an appropriate opportunity for addressing the issues and solutions because the aim is about building resilience in the regional water sector due to the climatological and hydrological risks and threats faced in the Caribbean.

In concluding his opening remarks and before commencing the day's agenda, as an icebreaker activity, Dr. Cain asked the participants what they would like to see improved in the water sector and what do you think the water sector in the Caribbean is missing. The following represents the responses given:

What do you think the WASH sector in the Caribbean is missing?

- Wastewater reuse
- Transparent and accountable reporting
- Managing wastewater for the agricultural sector
- Managing water for the agricultural Sector
- Poverty and sanitation
- Accountability from the applicable institutions
- Affordable financing
- Wider access to water
- Gender sensitivity
- Dealing with rapid urbanization
- The buy-in and engagement of the public
- Building resilience in the water infrastructure
- Making the stronger link between water and sanitation
- Silos mentality by those employed in each area.
- Research

- Enforcement of rules and regulations
- A clear service cost recovery model
- It must be improved
- Public knowledge
- More public education
- More public education and compliance
- More education/inclusion at the youth level
- data
- A clear linkage between all three.
- Steady financial support
- It is missing more public private partnerships to marry the science
- Human Centered
- Resource recovery
- FUNDING
- More regional cooperation in research
- Simple consistent messaging around need for water and wastewater management
- Disconnected from the public. People need to know more about the water sector and the challenges. How it affects their lives.
- Integrated framework
- Transparency
- Capacity
- A public face
- Eco-friendly solutions/integration of the environment
- Financial Resources
- Making a business case considering the health and environmental aspects
- High Level Recognition that we need a more integrated approach to water and wastewater management including issues of sanitation.
- More investment
- A voice
- Sustainable funding
- Affordable low-cost wastewater management systems for low-lying coastal villages?

Paper Session 4: Public Health & Water Quality

This session was moderated by Mr. Miguel Montoute a Water Resource Specialist at the Water Resources Management Agency (WRMA) in St. Lucia and a member of the GWP-C Technical Committee.

Three (3) presentations were conducted in this session.

Presentation 1 – Mr. Miquel Garcia, Graduate Student of University of Trinidad, and Tobago under mentorship of Assistant Professor Deanesh Ramsewak

Mr. Miquel Garcia's research examined the seasonal extent of riverine plumes and the intense flooding in the Gulf of Paria of Trinidad and Tobago. The question he sought to answer is whether satellite RS can be used to derive and classify chlorophyll-a and turbidity estimates within the Gulf of Paria and how surface plumes affect coastal resources.

Mr. Garcia shared he used remote sensing to determine the physical characteristics such as size, travel direction and shape. He also looked at the difference between wet and dry season plumes and how the events of such floods affect the marine resources. He introduced listeners to what is a surface plume where he examined the composition of chlorophyll-a and turbidity within the water column of the Gulf of Paria. Chlorophyll-a at regular levels shows an important phase in the food chain in the water column but as concentration increases, we start beginning to see issues. On the other hand, turbidity at high concentrations demonstrate the blockage of light and the carriage of heavy metals and other forms of pollution as they attach to sediments such as shellfish.

The area of the study focused on the Gulf of Paria and the area outside of the Caroni swamp. The Caroni swamp is a protected site and home to many ecological sensitive species and a key commercial fishing ground for shellfish. The swamp is an important area for food production in the region.

The methodology of the research utilised image selection to investigate the study area. The images were used to delimit the study area and applied atmospheric correction. Various models were selected for processing in ACOLITE to determine the chlorophyll-a and turbidity estimates which were then filtered. These were then classified using Jenks Natural Breaks into four (4) classes and different map products were built in ArcPro using chlorophyll-a and turbidity.

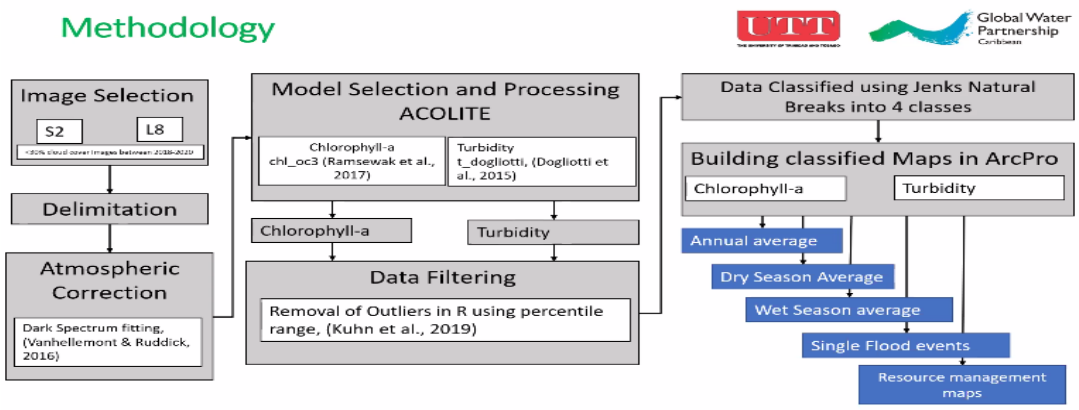

Figure 15 – Methodology used to determine the chlorophyll-a and turbidity estimates.

The results were then classified into four (4) categories with values ranging from background to hypereutrophic. Specifically, for chlorophyll-a the range for class 1 was background levels, which is the level you expect to see within nature at any point in time. In class 2 we saw eutrophic to hypereutrophic waters, class 3 involved hypereutrophic to potential dead zone and class 4 was hypereutrophic to dead zone. As the number gets higher the quality of water reduces. The mean background levels were compared to the results reported in the State of the Marine Environment (SOME) report of 2016 . The study of chlorophyll-a found the mean level to be 2.45 mg/m^3 of water while the SOME report estimated the mean to be 2.52 mg/m^3.

Chlorophyll-a range (mg/m^{-3})	Turbidity range FNU	Jenks Natural Breaks Class	Classification range
0.218 to 4.350	0.490 to 42.0320	1	Background levels
4.350 to 26.749	42.032 to 142.798	2	Eutrophic – Hypereutrophic
26.749 to 123.766	142.798 to 302.931	3	Hypereutrophic – Dead-zone
123.766 to 261.77	302.9305 to 623.164	4	Hypereutrophic – Dead-zone

Figure 16 – The classification of turbidity and chlorophyll- a results.

The composition of turbidity results showed that most of the site had generally low levels of turbidity with values increasing in approaching the swamp. The pie chart showed the average percentage coverage in the turbidity plume for category 1 is 92 which is most of the study area. The average turbidity results of the entire study site was compared to the results of turbidity in the wet which showed an increase in the class 2 plume and results for the class 3 and 4 plume were negative. For the dry season we observed a decrease in the coverage of class 2 from 7 to 2 and class 3 plumes formed.

Mr. Garcia turned his attention to the trends of chlorophyll-a plumes, which were almost the opposite of the turbidity results, since there was a higher level of chlorophyll-a in the Gulf of Paria due to the nature of the area being enclosed resulting in a lot more nutrient in the Gulf being observed.

The trends between the dry and wet season showed chlorophyll-a concentrations in class 2 and 3 plumes decrease and in the dry season we see them almost double in size.

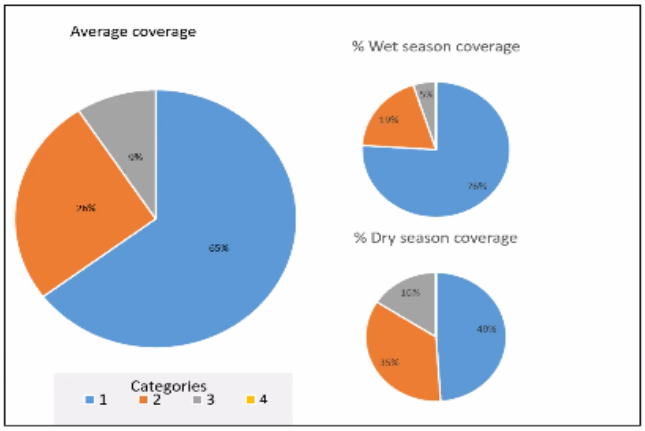

Figure 17 - Pie Chart showing the trends of Chlorophyll-a plumes.

Turbidity levels in the Gulf of Paria show that generally in the wet season the amount of class 2 plumes increase due to increase rainfall and the river discharge velocity, due to the pushing of heavier sediments further into the Gulf. This causes more effects to resources in the Gulf and effects to different habitats will be seen that are not usually seen. Thus, more frequent storm activity and changes in the climate will show severe effects. On the other hand, for Chlorophyll-a we see a drastic increase of these levels and due to flushing in the wet seasons where stagnant water from the Caroni swamp is pushed out and from the opposite end, we see more water pushed into to the Gulf .

A single flooding event was compared to the average levels expected to be seen during the wet season. This flood event occurred between the 16th to 19th November 2018 and a satellite image was taken on the 20th of November. The composition plumes matched the average almost exact, where the class 2 plumes are slightly larger than the expected average for the area .

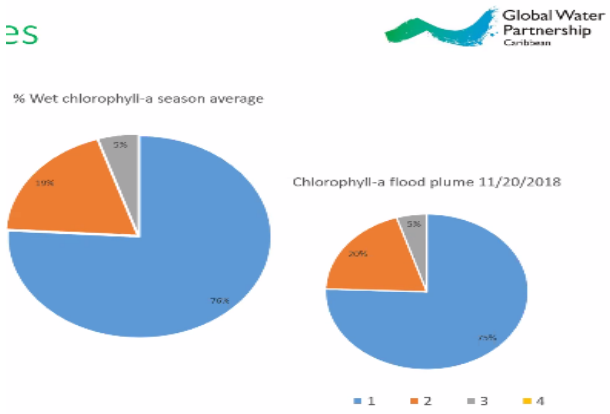

Figure 18 - Pie chart showing single event plumes compared in wet and dry season.

The effects on habitats in the region were also analysed. A chart displayed different habitats outside the Caroni swamp from sea grasses to shell deposits. During the wet season it was noted that the main areas affected are the sea grass beds. Mr. Garcia stated chlorophyll-a can lead to sea grass bed degradation due to reduced light penetration, high competition for nutrients and change in species composition. Thus, this would affect the food resource in some way since Caroni swamp serves as a nursery ground and commercially important fishery area.

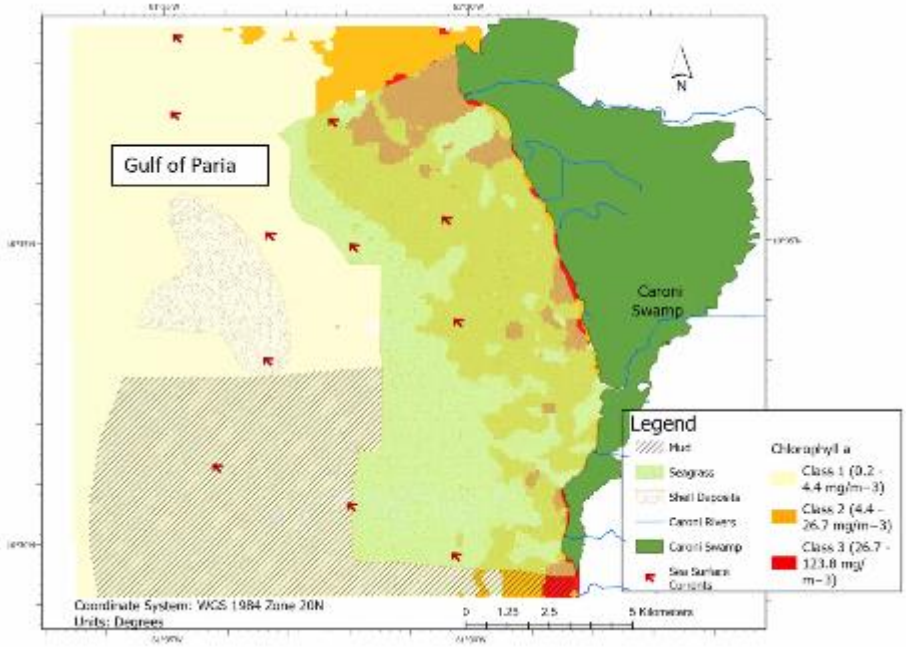

Figure 19 - Map showing effects on different types of habitats.

An effect on shrimp fisheries was observed and a map was shown to illustrate specific shrimping grounds in the region ranging from type 1 to type 4 . A high impact on type 1 and 2 grounds from the chlorophyll plume 2 was detected but all fishing grounds were affected in one way or another by the chlorophyll class 2 plumes. In looking at the sediments containing heavy metals there is an effect on the health of organisms, which will inevitably lead to decrease in oxygen leading to dead zones within the area, further affecting water quality which traces back to human health.

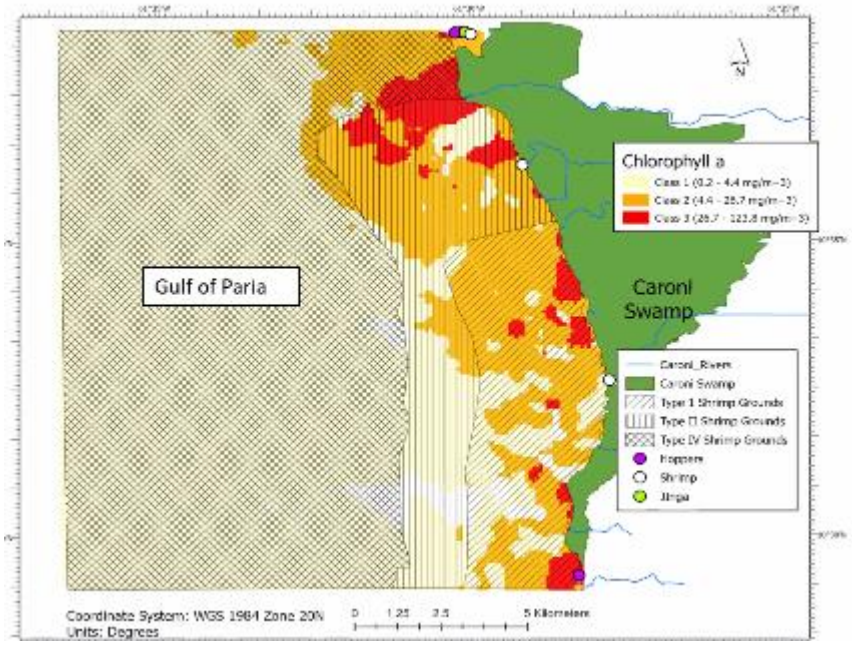

Figure 20 – A map showing the areas where there is an effect on shrimp fisheries.

Mr. Garcia concluded by recognising that monitoring river output and plume trends will be an important feature in ensuring sustainable and safe coastal resource use especially when looking at human health in the area. We must understand where or when elevated contaminant levels may be present in the nearshore environment, as this allows for accurate decisions on safe harvesting and resource utilisation. However, he explained that the study did not look at actual pollution composition in the water column and this is always an area for further research within that area. Continued research like this along with in-situ information on the chemical make-up of plumes and flood events can guide public health policy on which areas should be fished or accessed during specific seasons.

Presentation 2 – Ms. Mihiri Bogollagama and co-authored through the department of Public Health and Preventive Medicine, St. George's University, Grenada

This presentation focused on nutrient concentrations in surface and subterranean water sources in the southern region of Grenada.

First it was highlighted that nitrates and phosphates are considered essential nutrients for plant growth but on the environment both elements are subject to physical and chemical changes. High concentration of nitrates and phosphate ions in the environment do indicate contamination from sources such as pesticides, herbicides, organic and inorganic fertilisers, and domestic waste rich in organic matter.

However, elevated concentrations of nitrates and phosphates is associated with negative environmental health impacts. For example, increase in dietary nitrate ion is associated with acquired methemoglinemia, accelerated eutrophication and carcinogenicity. Ms. Bogollagama explained that studies have recognised that phosphate irons are a critical factor in mineral and bone disorders and compelling evidence shows association with chronic renal and cardiovascular disease.

Ms. Bogollagama shared a graph showing Grenada experiencing two (2) climatological seasons, which are the dry season from January to May and the wet season from June to December with a mean annual rainfall of 500mm. Grenada has 71 designated watersheds and 95 per cent of potable water in Grenada originates from surface water bodies. In areas where potable water is acquired from rivers and streams, the inadequate management of the surface runoff can result in nitrate ion and phosphate ion contamination. Some treatment plants in Grenada are source to agricultural and urban activity. Therefore, it was emphasised that it is important to establish safe water.

The study areas identified in the research were Annadale located in the parish of St. George's a surface water source and the groundwater source from Chemin located in the parish of St. David. Annadale is in a nature reserve and serves a large population in Grenada, while the Vendome and Chemin treatment plant serve a small segment of the population affected by agriculture and urban activity due to their location.

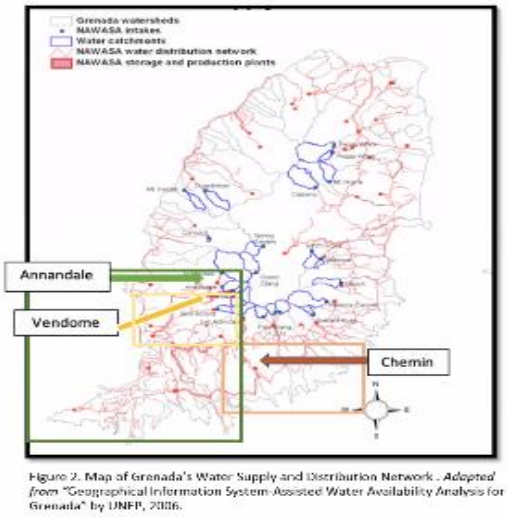

Figure 2. Map of Grenada's Water Supply and Distribution Network . *Adapted from* "Geographical Information System-Assisted Water Availability Analysis for Grenada" by UNEP, 2006.

Figure 21 - Map showing study in southern Grenada.

The aim of the research was to determine the physiochemical characteristics and nutrient concentration of surface and subterranean sourced water in the southern region of Grenada during two (2) meteorological seasons, with the goal of establishing baseline parameters for continuous monitoring. The results showed seven (7) different samples taken from the treatment plants in the dry and wet season. In both seasons the pH increased after treatment, however the temperature did not change when comparing the two (2) seasons and the overall conductivity was higher in the dry season. The ground source water had a notable higher conductivity when compared to the surface water suggesting the presence of a significant amount of inorganic soil/salt.

In Figure 22, the total nitrogen concentration when looking at the surface water in the rainy season in the Annadale plant increased from 3 to 6 mg/L and the Vendome plant decreased from 5 to 0 mg/L. Regarding the groundwater source in Chemin, the treated water decreased from 6 to 5.5 mg/L. In the dry season the total nitrogen concentration in groundwater in Chemin was notably higher than the surface water sources, which may suggest bleaching of nitrogen compound, since nitrogen plays a huge role in agricultural practices. In the dry season Vendome was the only plant where the nitrogen source decreased substantially after treatment, putting it below the EPA guidelines. During both seasons, all water was border line and below the guideline except for the treated water in Chemin in the dry season.

Figure 22 illustrated nitrate concentrations and all three (3) sources had values below the guidelines set by the EPA. Nevertheless, during the rainy season concentrations of nitrate increase significantly in all three (3) sources because of surface runoff. These significant findings show that though Annadale treatment plant's nitrate fell below the guideline, the concentration increases both treatments.

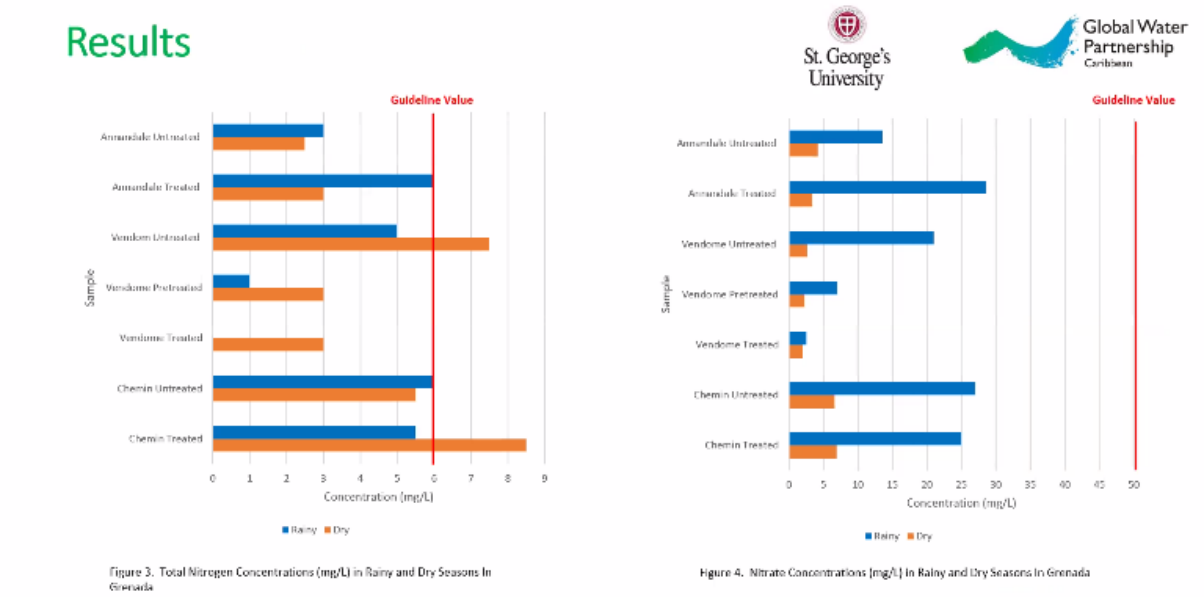

Figure 4 - Bar Chart showing the total Nitrogen and Nitrate in Rainy and Wet Season in Grenada.

In conclusion, in the rainy season all three (3) plants had concentration of ammonia that were higher than the threshold value and suggest the presence of nitrogen compound likely originating from organic matter which is significant in the rainy season. The Vendome plant was the only plant able to bring ammonia concentration to 0 after treatment and have a concentration below the threshold value. Contrastingly, in the dry season the concentration of ammonia was below threshold concentration except for Chemin being slightly above. Phosphate concentration decreased after treatment in both wet and dry season. However, phosphate concentrations exceeded USEPA values in small samples and the guideline value was still exceeded. It was observed that phosphate is higher in the dry season. Total nitrogen and nitrate concentrations were generally lower than USEPA Guideline values. Nitrate concentrations were higher in the rainy season, while nitrogen concentrations were higher in the dry season.

Presentation 3 – Ms. Akilah Stewart, Department of Life Sciences FST University of the West Indies

This presentation focused on the water poverty index of three (3) rural communities in the southern Caribbean.

Water was identified as one of the most critically stressed resources as reflected throughout the symposium. It was recognised that globally, 4.3 billion people face severe water availability challenges at least one month a year and because of climate change and variability which is expected to get worse. These issues have a significant impact on water resources which can affect the overall welfare of society.

Water resource challenges were highlighted in the Caribbean which ranged from increasing deforestation, uneven distribution of water supply, water scheduling, low per capita water availability in many countries, accessibility where populations living in rural areas are more susceptible to water availability issues, poor water infrastructure, leaking mains, storage capacity and water quality.

Ms. Stewart explained to attain all this information, there are several water availability indices for measuring water resources, and they are important because they can be used to establish links among water availability, physical aspects, and socioeconomic factors. One tool developed for this purpose is the Water Poverty Index. Hence, Ms. Stewart in her research sought to identify the water availability issues facing rural communities of the southern Caribbean and the water poverty index of rural communities of the southern Caribbean.

This was investigated using the water poverty index which has been used in various publications and research. It consisted of 5 sub-components which are resource, access, use, capacity, and environment which have important implications for the water sector. The work was done in the Caribbean in Nariva Trinidad, Carriacou Grenada and Speightstown Barbados.

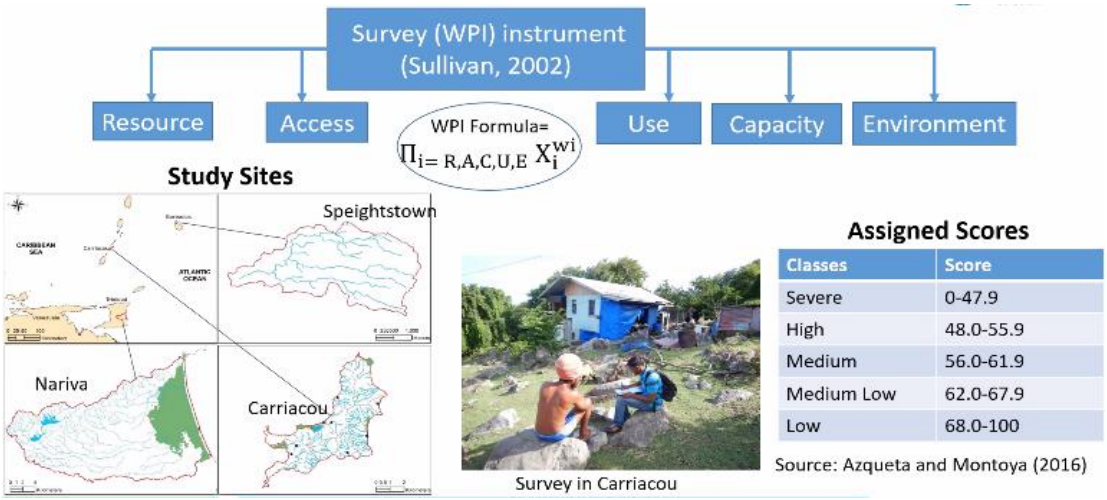

Figure 23 – Methodology using the WIP instrument and its subcomponents.

The results were acquired through a survey instrument in three (3) communities where 205 were in Speightstown, 218 in Nariva and 188 in Carriacou. Many of the communities were from rural means, rainwater harvesting was practiced in Nariva, and Carriacou. However, Barbados was identified as very water scarce and did not have rainwater harvesting. Water was used from environmental sources such as springs and wells in all three (3) communities and only in Nariva and Speightstown they were centralised distribution systems.

A calculation of the per capita water availability was completed for each of the communities and Speightstown and Carriacou would have fallen below the Falkenmark indicator of 1000 m^3 as presented in the log scale. Overall, it was observed that the per capita and water availability mirrored each other but was lowest in Speightstown and Carriacou because less water resources are available in general.

Community Water Resource Characteristics

Characteristics	Speightstown (n= 205)	Nariva (n=218)	Carriacou (n=188)
Rural /Semi-subsistence	✓	✓	✓
Harvest rainwater		✓	✓
Water Scarce	✓		
Environmental water	✓	✓	✓
Centralized distribution system	✓	✓	

Water availability and per capita water availability

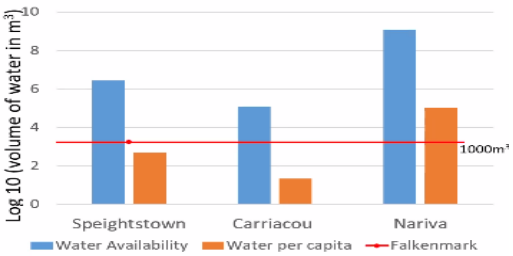

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Figure 24 - Bar Chart showing community water characteristics and water availability and per capita water availability

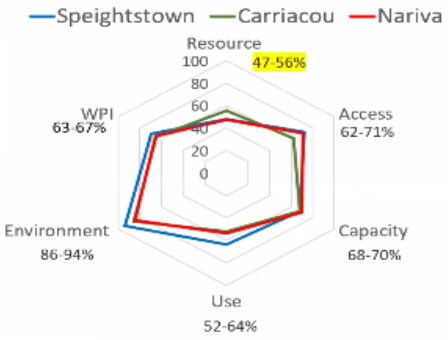
The results for the Water Poverty Index Scores were medium low for all three (3) categories. Lower scores were observed in the resource subcomponent of the formula due to availability and precipitation data which was found. However, there was no statistically significant difference between the Water Poverty Index of the three (3) countries although they represent different geographical backgrounds.

Results

WPI SCORES

Global Water Partnership Caribbean

	Speightstown	Carriacou	Nariva
Resource	49	56	47
Access	72	62	71
Capacity	68	68	70
Use	64	52	54
Environment	94	86	86
Total	67	64	63
WPI category	**Medium-low**	**Medium-low**	**Medium-low**



- Lowest scores in Resource subcomponent - Availability and Precipitation
- No statistically significant difference between the WPI of the 3 countries

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Figure 25 – Chart showing the WPI scores of the studied areas.

From this study it was concluded that water resources remain a challenge and water conservation measures are fundamental and highly variable around different areas. However, one country can learn from the other. It was recognised that all communities used unaltered water at least one month a year from springs and wells and these areas are not tested for water quality, which can have health implications and must be monitored continuously.

Communities with higher rates of water storage see the practice as an important one. The capacity subcomponents of the index have the potential for improvements in Carriacou while the use scores are affected by the degree of irrigation and degree of water conservation. Carriacou demonstrates why only using physical water scarcity is not ideal, higher scores in access and environment subcomponents were observed and are stable but there is a need for further standardisation of index inputs based on availability of data.

It was recommended that there should be more efficient use of existing practices such as water recycling and increased rainwater harvesting. Rainwater harvesting success in Carriacou can be a model for other Caribbean islands. Equally, greater focus should be on the multiple benefits of water harvesting such as increases in water availability together with flood management.

Q&A Paper Session – Public Health and Water Quality:

- Miquel - What are the opportunities to apply this to freshwater sources?
- Are we testing raw water sources for micro plastics and glyphosate in the region? Micro plastics in wastewater?
- To Akilah, good work. Can you expand on the capacity subcomponents of the WPI? And can you share Carriacou's RWH successes?
- Akilah Stewart -You said that you are doing more research on water quality, can you tell us more about your concerns in terms of health implications.
- To Ms. Akilah; which one was rainwater, and which was river water?
- Presenter 3: How do your results compare with earlier WPI work in Carriacou undertaken by Candi Hosein in 2013
- Akilah, by "unimproved" sources was this limited to the drinking water ladder only or was the sanitation ladder considered as well?
- Presenter 3- Is rainwater harvesting generally being implemented for potable or non-potable use in the communities studied? What are the implications for the WPI when rainwater is not potable i.e., when it is not treated as safe for drinking?
- Presenter 2: The work demonstrates that there is a need for the development of cheap cost-effective water quality testing methodologies. What do you think are the emerging opportunities to address this gap?
- For the second presenter, there is often a lack of capacity for monitoring nutrients on a routine basis. Based on the study in Grenada, what specific parameters or forms of nitrates or phosphates would you recommend monitoring for as a priority?
- Presenter 2-Are most water intakes in Grenada covered by the study below agricultural lands?
- Mihiri, do you know if the plants where the samples were taken are regularly maintained, would this have affected their capacity to remove those chemical contaminants?
- Ms. Bogollagama, you mentioned in your presentation that there was pretreated water for one of the treatment plants - what was it treated with?
- For the first presenter, do you think the application of remote sensing methodologies could be easily used by other countries to monitor for Chlorophyll a and turbidity?
- How many days after the rains was sampling done? this may impact the concentration
- How often was the sampling done? how many samples ? Was any isotope study done i.e., isotopes of N.? How do you confirm that the concentration increases due to leaching or surface water runoff? Was leaching studies done ? or nitrate in soils? was surface water also analyzed?
- Mihiri, - what is the annual rainfall in Grenada?
- Presenter 1: Where else in the Caribbean do you think it would be beneficial to use the approach described?
- Presenter 2 - Why are the phosphate concentrations higher in the dry season as opposed to rainy season?
- Miquel, where can we keep up with your research?
- Presenter 1- Can you clarify a bit by what is meant by type 1, 2 and 3 shrimp grounds?

In closing, Dr. Cain commented on the usefulness of this session which informed of techniques such as remote sensing to identify the deficit in the water resources and the necessity of data for analysis. Moreover, Dr. Cain commented on the analysis of the peculiarities in the dry and wet season as it relates to the concentration in wastewater after it is treated. He recognised this data and analysis is very important as wastewater is one source of water that can be utilised to manage our deficit of water by the reuse of wastewater.

There was the launch of GWP-C's knowledge product by Ms. Gabrielle Lee Look, GWP-C Communications Officer which is a children's book. This book takes the reader on an educational adventure through the beautiful and intriguing Caribbean. Moreover, it documents the journey of a pair of twins and their parents as they navigate by yacht to 15 destinations in the Caribbean to observe water security issues plaguing each territory and possible solutions.

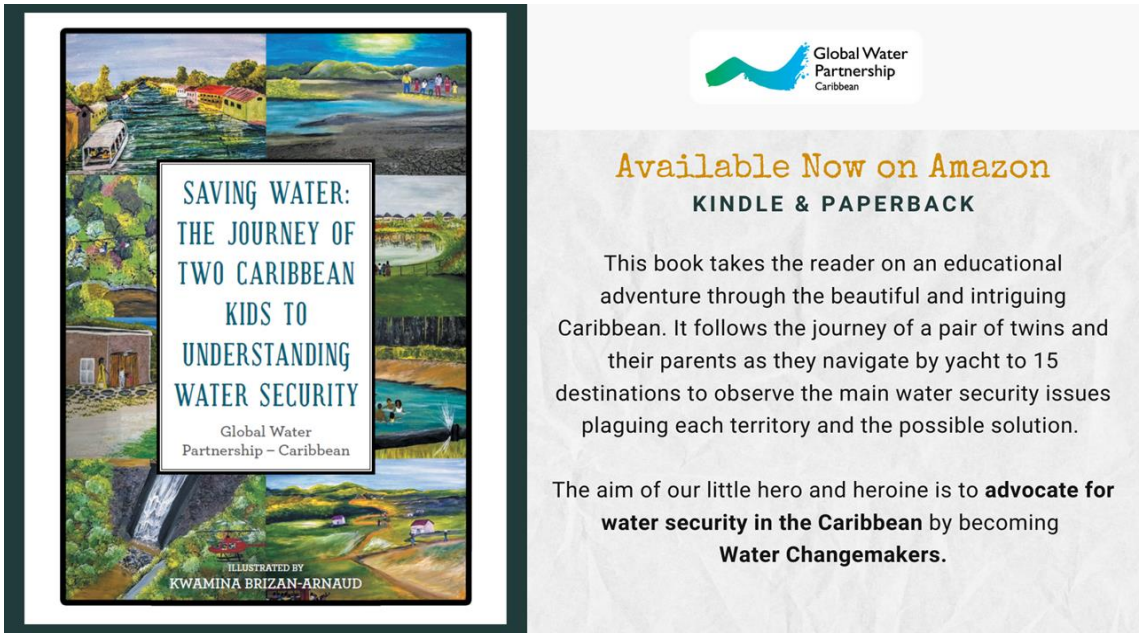

Figure 26 – The Knowledge Product launched by GWP-C which is available on Amazon.

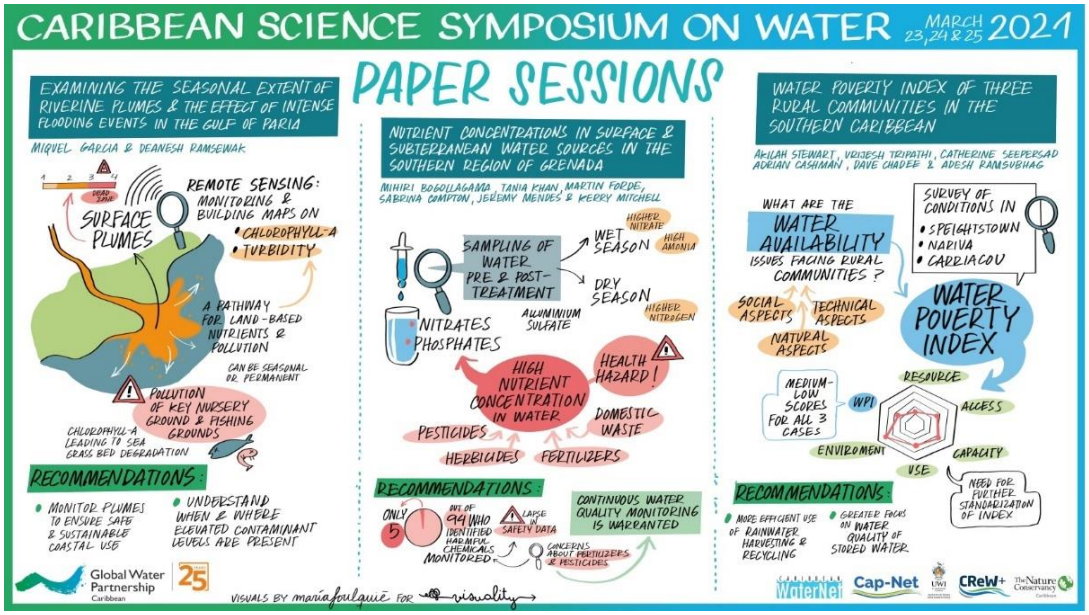

Figure 27 – A visual summary of paper session 4 on public health and water quality.

Presentations and Round Table Discussion: Wastewater Management

This session was facilitated by Mr. Christopher Corbin, Programme Officer at the UNEP Cartagena Convention Secretariat and Caribbean Environment Programme and GWP-C Technical Committee Member. He congratulated GWP-C for recognising the importance of improved wastewater management as a key aspect of Integrated Water Resources Management (IWRM) and building resilience in the water sector. The focus of this session was to illustrate explored research and possible actions that can be taken.

Presentation 1 – Mr. Adam Snyder, Conservation Campaigns Manager of The Nature Conservancy

Mr. Adam Snyder's presentation dealt with wastewater management in the Caribbean with the specific focus on barrier, opportunities, and nature-based solutions. He began by enlightening listeners on the work of The Nature Conservancy (TNC) in the Caribbean which has a focus on three (3) main areas:

- Ensuring healthy productive **oceans**.
- Protection against **climate change.**
- Monitoring, restoration, and protection of **coral reefs**.

Wastewater management can be applied in any of these areas. However, Mr. Snyder expressed the Nature Conservancy does not have a history of working on wastewater management and is relatively new to the issue of wastewater management but has a long successful history on working on projects that promote nature-based solutions from coral nurseries to artificial coral reefs, to marine protected areas, protecting headwater streams etc. Nature-based solutions are their core tools for protecting and restoring nature.

Mr. Snyder's study sought to examine the scientific, policy and stakeholder barriers and opportunities for wastewater management in 4 countries (Dominican Republic, Haiti, Jamaica, and Grenada) and to understand the role of nature-based solutions. In advancing the research, the team focused on conducting desk research of existing scientific studies, policies and stakeholders related to wastewater management. It was taken further by setting-up interviews with academics, professionals, and NGOs to gain their opinions of wastewater and the role of nature-based solutions. Additionally, public opinion research was used by engaging the public through online focus groups in three (3) countries to study the public's attitude about the issues and potential solutions to resolve wastewater issues.

From this research, it was discovered that Santiago in the Dominican Republic has been developing constructive wetlands to improve waterfall for the last 7 years. The projects are usually smaller but have been successful. The Yaque del Norte water fund spearheaded many of these projects. In Jamaica, constructive wetlands are more prominent at the Dunns River falls and parks where local and tourists' attractions are on the north coast as the wastewater treatment facility helps support 10,000 visitors per day. In Haiti, Mr. Snyder highlighted the Caracol Industrial Park features a cascading system of engineered wetland ponds that filter wastewater to notable standards.

In looking at some of the barriers, governments are dealing with environmental concerns in regional wastewater management and wastewater management lacks the proper political priority to protect biodiversity and human health. Moreover, it was disclosed that agencies are silent and fail to coordinate and lack the mandate to fully cover all the wastewater needs. Most countries have focused on the drinking aspect of water and inadequate attention on wastewater management. We observed this fault in Haiti particularly, who only opened its first wastewater system in Port Au Prince and one of the last major cities in the world to not have a wastewater system. However, they have been working hard to improve their wastewater system.

Mr. Snyder concluded that there is "too much of an out of sight out of mind mentality" and it is difficult for nature-based solutions to be considered. From our analysis of wastewater, it allows nature-based solutions to be a predominant option and an effort must be made to turn the attention of stakeholders and local governments to focus on wastewater management as a solution.

Presentation 2 – Mr. Pedro Moreo, Regional Coordinator for the GEF CReW+: Implementing solutions for an integrated water and wastewater management for a clean and health Caribbean.

Mr. Pedro Moreo gave a general background on the GEF CReW. It was explained that the GEF CReW, a Caribbean Regional Fund for Wastewater Management, was started in 2011 in the House of the Cartagena Convention Secretariat. It was articulated that GEF wanted to test and create an innovative finance mechanism because of the needs of the Caribbean region to develop a water and sanitation system.

Some of the achievements of the previous GEF CReW were highlighted which included:

- Participation of 23 institutions in capacity building activities for wastewater management.
- Households were provided with access to improved wastewater treatment.
- 40 organisations participated in awareness building activities.
- 12 new wastewater treatment plans completed.

Moreover, it was disclosed that the GEF CReW+ is a continuation of GEF CReW, through the implementation of solutions for Integrated Water and Wastewater Management (IWWM) for a clean and healthy Caribbean. Therefore, the objectives achieved involved additional countries with reformed institutional, policy and legislative frameworks for IWWM, 5,000,000 cubic meters of treated wastewater per year which showed an increase and there was an increase in households benefiting from improved wastewater treatment.

In closing, he shared that a CReW+ Academy is part of the capacity building plan which will include a series of webinars, to identify the next steps in this capacity building plan.

Presentation 3 – Put your Money, where your Water is! Contributing to Resilience in the Wider Caribbean Region through a Circular Economy Approach in Water/Wastewater – Ms. Katharina Schaaff GIZ & CReW+ Sanitation for Millions

Ms. Katharina Schaaff discussed two (2) concepts, resilience and circular economy, to bridge the gap between the two. In a graphical representation, resilience was defined.

A linear development (the green line also covered by the orange line) reflects an economy facing no risks, hazards, or vulnerability to natural events. As depicted in the graph, an economic system that develops linearly continues to move up. However, that is not the reality since we face different hazards and threats are expected. Thus, what it means to have no resilience to hazards means we fall deep as shown by the blue line, which means we fail to recover quickly from shock or events. Consequently, resilience has two (2) aspects which are resisting shock, not falling as deeply and recovering quickly as shown on the orange line.

On the contrary, a circular economy is a model of production that tries to make the best use of the resources available. It involves sharing, reusing, and repairing our products to the utmost extent to make best use of longer sustainability in the economic sector. Moreover, Ms. Schaaff indicated a blue economy involves the externalities of the environment and social externalities, such as social equity being enhanced. In the wastewater sector it means reducing the pollutants to prevent contamination and allowing for recycling of wastewater and the recycling of nutrients through safe treatments.

Hence, in linking the concept Ms. Schaaff emphasised the circular use of water resources contribute to resilience in the Caribbean through reducing, reusing, and recycling. This means it has the benefit of decreasing our dependency on the scarce resource of water since drought continues to affect the Caribbean due to the onset of climate change. It reduces the risk of cascading events, such as flooding and contamination of an area. Moreover, it increases efficiency and redundancy of water provision since if we reuse, we have two (2) ways of accessing adequate water for agricultural activities and other social needs.

Ms. Schaaff continued to explain the circular use of water resources allows for the recovery of the ecosystem to increase our resistance to natural events and contributes to equal access of ecosystem service. Therefore, vulnerable parts of society can survive unexpected events/shocks and social resilience. Ultimately, Ms. Schaaff stated resilience is built at the local level and works best in a local context.

In conclusion it was expressed that Integrated Wastewater Management contributes to a more resilient Caribbean and CReW + works to contribute to a resilient Caribbean. Some of the ways this is achieved is through:

- Policies – by setting standards for reuse of treated wastewater in agriculture, as in Trinidad and Tobago.
- Financing – working on tariffs that incentivise efficient use and social equity. Access is included even to the more vulnerable part of society.
- Construction – in Omoa Honduras a local treatment plant is being created to establish multiple benefits for the community and nature.
- Communication – there is a hope to create knowledge products documenting blue economy practices in water and wastewater for replication in the Caribbean and beyond.

In winding-up this session, an invitation was extended to participants for comments on changes they hope to see as it relates to wastewater management in the Caribbean. Mr. Wayne Williams, Executive Director of the Caribbean Water and Wastewater Association (CWWA) emphasised the need for political priority and the rate of wastewater tariffs are very low and needs consideration. On the other hand, Mr. Ignatius Jean, Executive Director of the Caribbean Water & Sewerage Association Inc. (CAWASA), indicated we must pay attention to how we treat wastewater and demand that more attention be given to this, as it can have tremendous impacts on our economy.

Q&A Round table discussion – Wastewater management

- As everyone benefits in one way or another from better wastewater management so is it fair for just those who are connected to a central wastewater system to pay the cost?
- Why not have screens fitted to drainage outfalls? They will not stop sediment, chemical and microbial pollution but they could reduce the plastic bags and bottles etc. that reach nearshore ecosystems.
- How can we apply low-cost wastewater technologies in low lying coastal villages where septic tanks are ineffective due to the high-water table?
- What are the best low-cost technologies for treating effluents from piggeries?
- Can you expand on what some of the concerns are regarding constructed wetlands and other NBS?
- How do we get more funding and increase technical capacity so that we can treat wastewater in The Caribbean?
- Is there an example in the LAC region of using treated wastewater in agriculture?
- Does the region plan to look at monitoring micro plastics in wastewater?

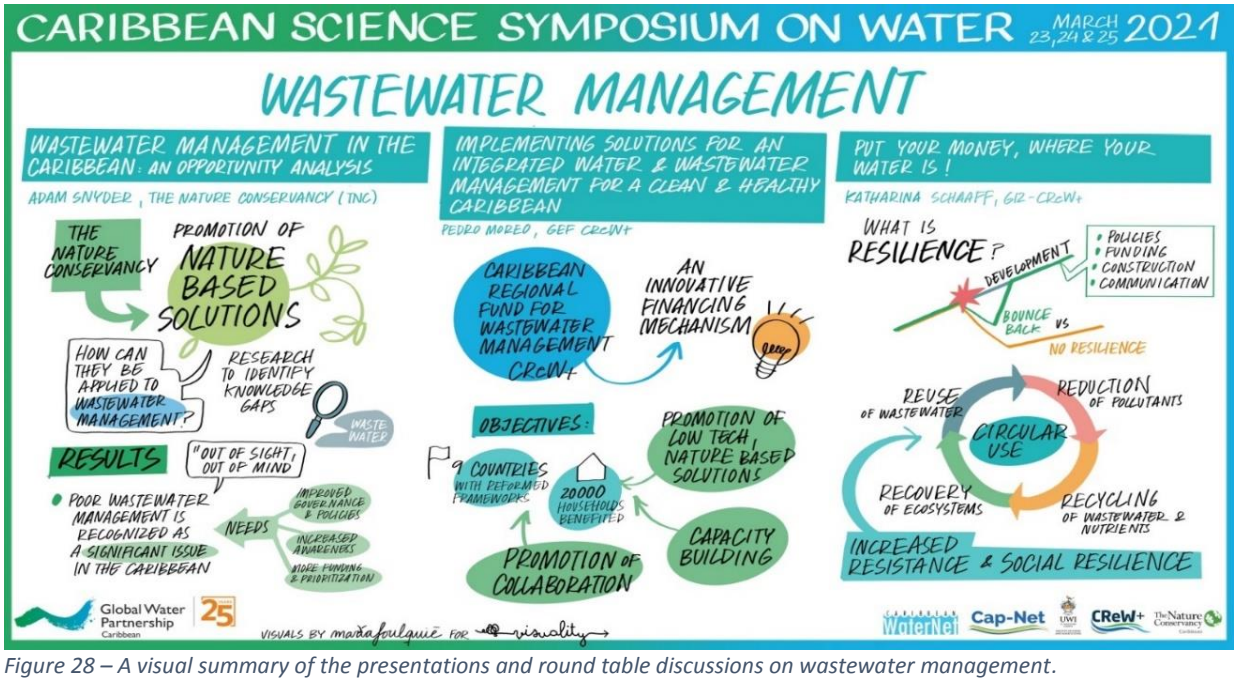

Figure 28 – A visual summary of the presentations and round table discussions on wastewater management.

Moderated Session: Time to take a regional approach to Integrated Water Resources Management (IWRM)?

This session was facilitated by Dr. Adrian Cashman and he stated when we come together the sum of what we can achieve is greater than the individual part. Dr. Cashman disclosed that collaboration and cooperation of regional entities are active through CARICOM's platform but the coordination at a regional level in the water sector, has been more elusive than the resource itself. Therefore, the purpose of the discussion is to seek to explore the reason for this reality and some of the possible ways forward. He asked "Is it time to take a regional approach to Integrated Water Resources Management (IWRM) in the Caribbean?" He then provided some background information by explaining that as far back as 2008 in a special meeting of CARICOM's Council for Trade and Economic Development of how the Caribbean as a region, is handling integrated water resources, considering the Johannesburg's World Summit and progress of plans on water efficiency.

He further continued by acknowledging that ministers of governments in the region endorsed the formation of CARICOM's Institutions of Water to assist with an approach to water resources management and to develop and strengthen water policy in IWRM Plans. In 2016 the CARICOM secretariat was able to access funds to develop a technical working group and produced a report in 2017 which identified issues affecting member states. This report contained high level recommendations as to what CARICOM and member states should do. However, this demonstrated one of the weaknesses of CARICOM, as it works by consensus, and you can only encourage countries on what they should do rather than demand.

From the 8th World Water Forum in Brazil 2018, the region started to develop a regional action plan for governance and building of climate resilience in the water sector which is ongoing. This aims to provide a platform to share information and to coordinate actions. However,
Dr. Cashman indicated it must be determined whether any progress is being made and I questioned whether this is the time we should be moving towards regional approaches and if so, what have those regional approaches started to look like. This background provided a starting point for the panel, where Dr. Cashman questioned whether we need a common approach to integrated water resources management in the Caribbean.

It was articulated by some panelists that there is a need for a common regional approach to the water sector rather than integrated resource management. It was voiced that the water sector is not treated with the level of importance by our regional institutions and there is no formal institutional mechanism for water within the Caribbean. Within the framework of CARICOM, certain institutions are organised for issues such as climate change but there is no formal gathering of water ministers in the region. There was a proposal in the Caribbean for an association on water and wastewater association, as an association that deals with water sector issues, which suggested a common approach is needed. The need for Integrated Water Resources Management was described as difficult, as it must be country specific and must be heavily political influenced.

The panelists in this moderated session included:

- Mr. Kareem Sabir – Senior Project Officer, Sustainable Development, CARICOM
- Dr. Orville Grey – Regional Manager – Caribbean & Brazil, GCF
- Mr. Evan Stephen Cayetano – Water and Sanitation Senior Specialist, IDB

- Dr. Chaney St. Martin – Water and Soil Management Specialist, IICA
- Ms. Tennielle Williams Hendy – Principal Hydrologist, National Hydrological Service, Ministry of Natural Resources, Mining and Petroleum, Belize
- Dr. James Fletcher – Managing Director - Soloricon Ltd. and Former Minister for Public Service, Information, Broadcasting, Sustainable Development, Energy, Science and Technology of St. Lucia from 2011 to 2016)

Dr. Cashman questioned Mr. Kareem Sabir, a senior project officer for sustainable development at the CARICOM Secretariat who explained CARICOM's position and the actions being taken . Mr. Sabir shared there is some progress, but it is slow. He also explained that in the context of The Revised Treaty of Chaguaramas, there is an article which deals with sustainable management of natural resources which indicates they are active on these issues, but such water initiatives are meant to be driven through the institutions that are already existing. Thus, there must be some commonality at national and regional levels and their various actions must be separated but CARICOM's role is merely to facilitate these institutions.

Dr. Cashman asked of some of the opportunities and prospects that may help with IWRM and some of the barriers. It was disclosed that a system to learn from what existed before should be in place and greater governance in how we hold leaders accountable for some initiatives that would have been sign onto. Moreover, there is a need for stronger advocacy to deal with the issues and holding the political community accountable to protect water resources and provide for efficient provision of water supply.

The use of the legal framework was also seen to minimise the destruction of areas that provide good water resources management. However, it was recognised one barrier we encounter is the government's ability to borrow from the numerous funds available. This poses a threat, as debt to GDP can preclude the desire to borrow. Contrastingly, the public health aspect of water must be tackled, there must be more work on collecting data, technological intervention, and legislative protection from the government to help with IWRM.

The panelists in concluding, gave recommendations on taking a regional approach to Integrated Water Resources Management (IWRM) which are as follows:

- True engagement to confront the extreme challenges of integration and communication.
- Joint project coordination and seeking assistance from regional institutions in interim to get plans started.
- Elevate water issues in terms of its importance on a regional basis, the same way we engage discussions on crime or economy.
- Engage regional institutions to update our water policy and where we can have interventions take advantage of them.
- Keep the momentum and be accountable.
- Continue to act, be more disruptive because the water sector is a critical sector which affects us socially and economically.

At the end of this session, Dr. Cain highlighted that articulating water issues has been a challenge, and there are several issues relating to governance, policy, and country level nuances which hinder attention to water issues. Countries prioritise other activities relating to nuances of their operations. However, Dr. Cain stated there must be engagement with the private sector and individuals at the community level, where they are brought to the forefront on these issues.

The issue of accessibility to data needs to be improved for risk analysis by the private sector to see how best contributions can be made to the issues in the water sector.

Furthermore, Dr. Cain emphasised this session, recognising that finance is an issue, and we need to identify how resources can be used in a country, as leverage for additional financing to mobilise action. Moreover, where the community is involved, issues of gender inclusion will arise. Dr. Cain commented traditional knowledge and practices come into play and when considering an integrated approach, we cannot discount what the community can contribute.

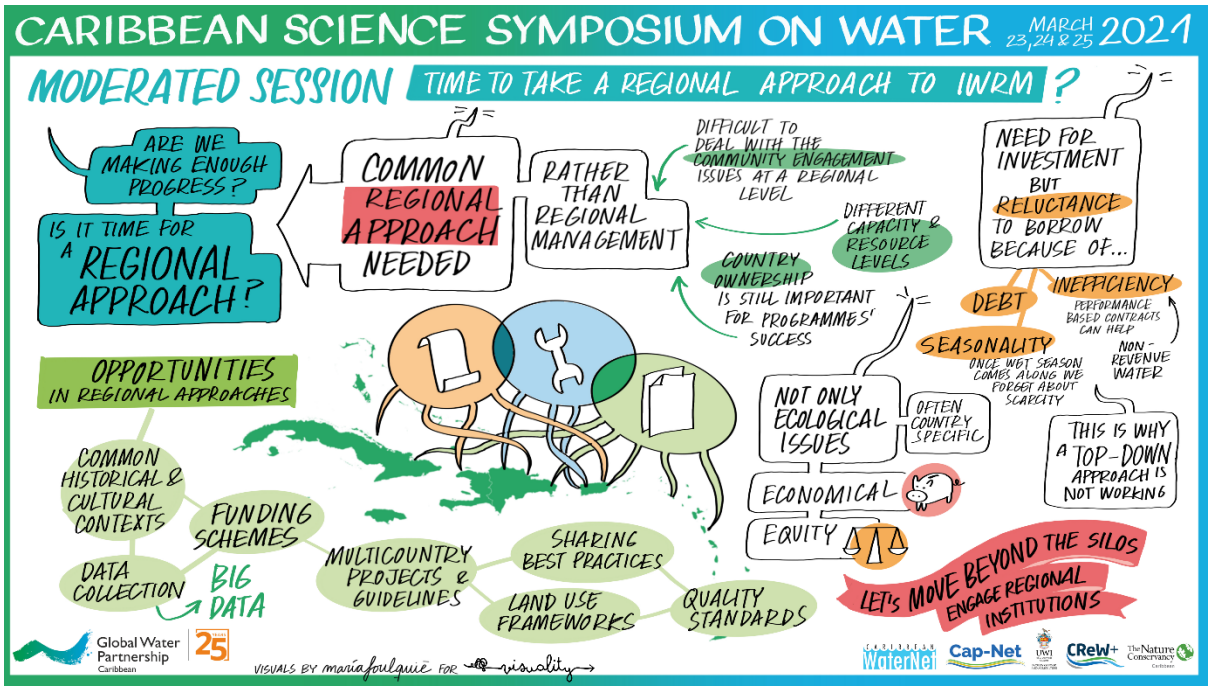

Figure 29 – A visual summary of the moderated session on taking a regional approach to integrated water resources management.

Closing Remarks and Next Steps

Dr. Kevon Rhiney concluded the symposium by summarising the main themes and key messages observed over the past three (3) days. The importance of producing robust and accurate scientific research was recognised. Moreover, Dr. Rhiney indicated this was also linked to the need for science to be communicated effectively in a form that is understandable and relatable. Another key theme taken away is the critical importance and cross-cutting nature of the water sector in climate mitigation adaptation. This stressed that the focus of the water sector must be at the table when other sectors are developing their adaptation plans.

Furthermore, a keynote echoed from discussions on bridging the gap between the policy and science divide was the importance of fostering and maintaining inter-sectoral collaborations. However, bridging the science and policy divide in the water sector must go beyond communication. It requires negotiations and trade-offs to build consensus among parties that may have different interests and goals which may at times require conflict resolution. Nevertheless, the right entry point for bridging the gap must be discovered so a generous and robust framework for collaboration can be generated, to offer a blueprint to the water sector holders in the region.

There was a continued reiteration of the critical need of the involvement of youth and women in the water sector. Youth are critical because they are change agents, and entrepreneurs. Thus, initiatives such as the GWP-C Shark Tank Competition that provide a platform for regional youth to showcase their immense talents must continue. Dr. Rhiney also shared the need to support alternative ways of storage of water systems, such as rainwater harvesting technologies, recycling of rainwater and wastewater resources was a key message to take away.

On the other hand, there needs to be some commonality in regional approaches to IWRM, while bearing the nuances of individual countries. Commonality should focus on quality water standards, building our infrastructures to develop the capacity to generate quality water standards, robust rationales for the water sector and use of big data where appropriate which can be used to mobilise multi-lateral financing for regional and international partners.

The last session raised the importance of the roles the private sector and communities play in water resources management and the transboundary opportunities and challenges for advancing regional cooperation around IWRM. Hence, this must focus on promoting knowledge transfer, gender equity, and building technical capacity. Dr. Rhiney shared some of the plans from the GWP-C Technical Committee on building from this inaugural science symposium. These are:

- To develop a communiqué that outlines the main messages gathered from the symposium and outlining some recommended actions.
- Releasing one position paper based on an emerging topic from this symposium.
- The GWP-C Technical Committee will produce 3 position papers this year available to the public.
- To use the insights from this event to engage our partners across the region.
- Development of knowledge products by the GWP-C Technical Committee.

He thanked the GWP-C Secretariat, Ms. Simone Lewis the Regional Coordinator who planned and organised the symposium, Ms. Gabrielle Lee Look, Communications Officer for designing the Symposium magazine and creating the event's website, Dr. Adrian Cashman for his support and commitment in advancing the water sector and all participants for making the symposium engaging.

Figure 50 – A word cloud based on participants describing the Caribbean Science Symposium on Water.

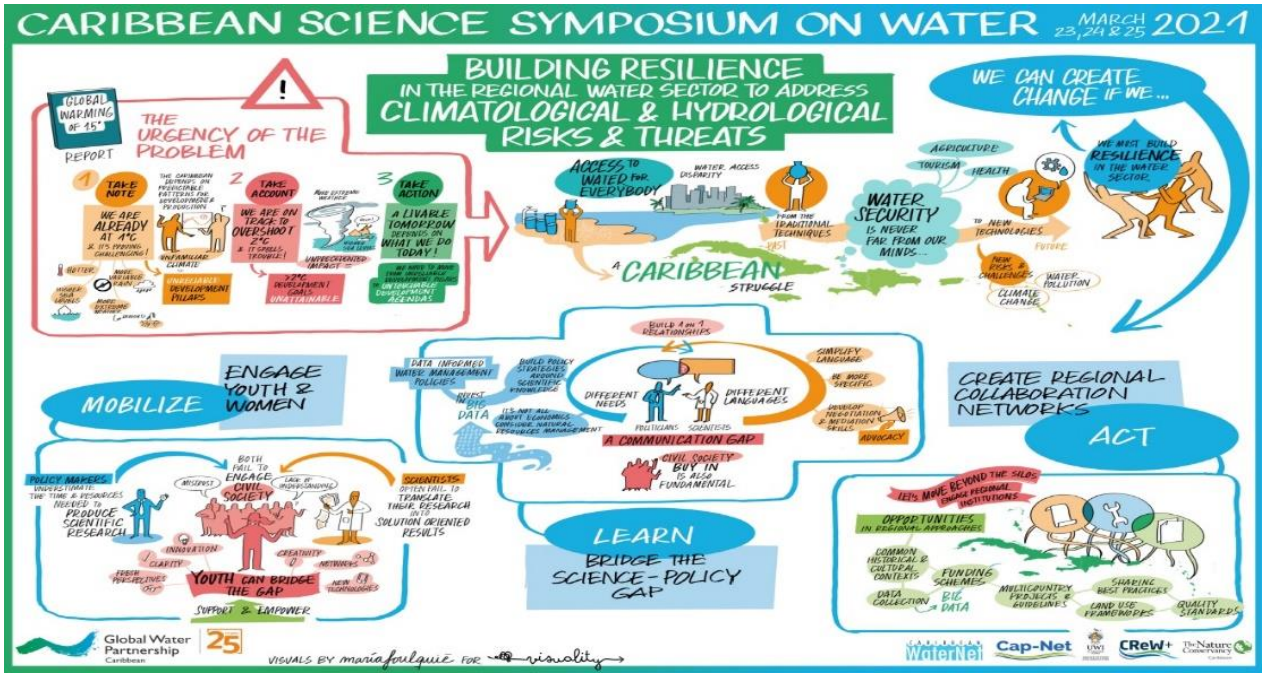

Figure 31 – A visual summary of the Caribbean Science Symposium on Water.

Appendix A – List of Participants

First Name	Last Name	Organisation	Job Title	Country
Chantal	Gaston	Water & Sewerage Company Inc	Laboratory Technician	Saint Lucia
Oliver	Nelson	University	Student	Jamaica
Neil	Van Dine	HANWASH	Vice Chair	Haiti
Hubert	Urlin	Waste Solutions Landfill Inc	Site Manager	Guyana
Randy	Williams	UWI Mona	Student	Jamaica
Raisha	Algoe	Suriname Water company	Junior planning officer	Suriname
Louis	Garraway	Environmental Management Authority	Environmental Programme Officer 11	Trinidad and Tobago
Deborah	Stoute Lynch	Organization of American States	Consultant	The United States
Kerron	Martinez	Global Water Partnership-Caribbean	Programme Assistant	Grenada
Cedric	Van Meerbeeck	Caribbean Institute for Meteorology and Hydrology	Climatologist	Barbados
Dalven	Harris	CME Services Limited	Operations Manager	Trinidad and Tobago
Mario	Wallace	NEPA	Environmental Officer	Jamaica
Ashley	Nemeth	NYU School of Law	Law Student	The United States
Sherry	Constantine	The Nature Conservancy	Director, Eastern Caribbean	Saint Lucia
David	Rogers	International Development Management	Consultant	The United States
Laurayne	Lucky	WASA	Project Officer	Trinidad and Tobago
Shenèe	Douglas		Student	Jamaica
Felicia	Persaud	Hydrometeorological Service	Hydro Chemist	Guyana
Frank	Grogan	Hydrometeorological Service	Specialist Hydrologist	Guyana
Crystal	Campbell	Civil Defence Commission	Duty Officer	Guyana
Devika	Rooplal	Toshiba Water Solutions America Inc.	Engineer	Trinidad and Tobago
Carlos	Rosal	Fundación SIMBIOSIS	Gerente Técnico	Guatemala
Shaneica	Lester	The University of the West Indies	Lecturer	Jamaica

First Name	Last Name	Organisation	Job Title	Country
Andres	Sanchez	Organization of American States (OAS)	Manager, Water Program	The United States
Avram	Primack	Indiana University	Lecturer	The United States
Angelika	Namdar	Anton the Kom University of Suriname	Senior Lecturer Spatial and Urban Planning	Suriname
Vaughn	Miller	National irrigation commission limited	System Operator	Jamaica
Dionyssa	Campbell	The Nature Conservancy	Operations Administrator	The Bahamas
Forrest	Smartt	Inter-American Institute for Cooperation on Agriculture	Climate Change Specialist	Guyana
Emily	Simmons	The Nature Conservancy	Water Funds Network Manager	The United States
Shawn	Meyer-Steele	Caribbean Desalination Association / H2OProfessionals	President / Director	The United States
Basil	Fernandez	Consultant	Hydrogeologist	Jamaica
Savion	Paddy	Ministry of Agriculture	Civil-Hydraulic Engineer/Project Engineer	Guyana
Quincy	Augustine	none	wildlife biologist	Grenada
James	Edghill	Ccl	Manager	Barbados
Lorenzo	Harewood	FarmFinder Global Inc.	Executive Director	Barbados
Cheri	Recchia	Summit Foundation	Director, Mesoamerican Reef Program	The United States
Judy	Daniel	Environmental Advisors Inc.	Senior Consultant	The United States
Mark	Wuddivira	The university of the west indies	Senior lecturer and HOD	Trinidad and Tobago
Miquel	Garcia	University Of Trinidad And Tobago	Graduate Student	Trinidad and Tobago
Derek	Charles	IICA	National Specialist	Grenada
Marlon	Givans	N.I.C	Systems operators	Jamaica
Anthony	Headley	Environmental Protection Department	Director	Barbados
Julia	Coombs-Robinson	York Castle High School	Senior Teacher	Jamaica
alessandra	giolo	Global Water Partnership	intern	Italy

First Name	Last Name	Organisation	Job Title	Country
Jacqueline	Syms	Caribbean Well Service Company Limited	Consultant	Trinidad and Tobago
Adelin	Pierre	World Youth Parliament for Water	Regional Focal Point - Americas	Haiti
Darren	Shako	H&S Water and Sanitation Services	Consultant	Guyana
Steve	Maximay	Science-Based Initiatives	Managing Director	Grenada
Vidjaya	Ramkhalawan	Environmental Management Authority	Assistant Manager - Technical Services	Trinidad and Tobago
Angela	Franklin	Guyana Water Inc.	Hydrologist	Guyana
Ockera	Moulton	UWI Mona	student	Jamaica
Judi	Clarke	JF Clarke Consulting Inc.	Climate change Adaptation Specialist	Barbados
Sharonda	Agard	Hydrometeorological Service	Hydrochemist	Guyana
Shevon	Cobis	Civil defense commission	Duty officer	Guyana
Aldrin	Calixte	Haiti Survie	Executive Secretary	The United States
Trisha	Beejai	EMA	Technical Officer	Trinidad and Tobago
RENARD	LINDO	Water Resources Authority	Hydrology Technician	Jamaica
Michael	Davis	Water and Sewerage Department	Engineer	The United States
Janelle	Christian	Private Firm	Development/Climate Specialist	Guyana
Isabelle	Vanderbeck	UNEP	UNEP GEF IW Task Manager	The United States
Gabrielle	Lee Look	Global Water Partnership-Caribbean (GWP-C)	Communications Officer	Trinidad and Tobago
Joaquin	Viquez	GIZ	Technical Advisor / Coordinator	Costa Rica
Lindonne	Glasgow	St. George's University	Assistant Professor	Grenada
Havelock	Binns	National Irrigation Commission	Senior works superintendent	Jamaica
Shawna K.	Lawrence	UNDP/UNOPS	National Coordinator	Antigua and Barbuda
N	Seepaulsingh	UWI	Student	Trinidad and Tobago
sharmaine	Artist	Suriname Water Supply Company	Process Engineer - Water Treatment	Suriname

First Name	Last Name	Organisation	Job Title	Country
Shainna	Tikasingh	Ministry of Energy and energy industries	Environmental Analyst	Trinidad and Tobago
Yemi	Knight	AnchorBridge Environmental	Director	Barbados
Romario	Morgan	National Environment and Planning Agency	Environmental Officer	The United Kingdom
Beverly	Monroe	Trinidad and Tobago Bureau of Standards	Standards Officer	Trinidad and Tobago
Yekini	Wallen-Bryan	Preelabs	CEO	The United States
Cyprian	Gibson	Water and Sewerage Corporation	Steering Committee	The Bahamas
Francisco	Nuñez	The Nature Conservancy	Central Caribbean Program Director	The Dominican Republic
Denise	Garcia	Environmental Consultant	Consultant	Belize
Christopher	McDonald	UVI	Researcher	The United States
Khadija	Stewart	Ecovybz Environmental Creatives	Founder	Trinidad and Tobago
Vivian	Joseph	Environmental Management Authority	Environmental Programme Officer	Trinidad and Tobago
Cornelia	Walters-Jones	Water Project Jamaica	Project Manager	Jamaica
Dietmar	Ruoff	GIZ	Senior technical advisor	Grenada
Anu	Hazell	SWRHA	R.N.	Trinidad and Tobago
Selva	Edwards	Land Images Design Group Ltd.	Landscape Architect	Trinidad and Tobago
Bradley	Downer	Ministry of Health - Guyana	Public Health inspector	Guyana
Sara-Jade	Govia	Ministry of Public Utilities	Water Sector Specialist	Trinidad and Tobago
Thara	Gabriel	Caribbean WaterNet	Administrative Consultant	Trinidad and Tobago
Joseph	Noel	Ministry of Agriculture, Lands and Forestry	Land Use Officer	Grenada
Soshanna	Mussenden	Aqua Treat Solutions Limited	Managing Director	Jamaica
Dwain	Cairo	Surinaamsche Waterleiding Maatschappij	Jr. Planning employee (electrical engineer)	Suriname
Kelly	Witkowski	IICA	Manager Climate Change and Natural Resources Program	The United States

First Name	Last Name	Organisation	Job Title	Country
Kevan	Lee Lum	Wood	Water resources Engineer	Trinidad and Tobago
ECLAC Artie	Dubrie	UNECLAC	Sustainable Development	Trinidad and Tobago
Michael	Andrews	Civil Defence Commission	Logistic Manager (ag)	Guyana
Raheem	Smith	Caribbean Youth Environment Network	Member	Grenada
Anuradha	Maharaj-Jagdip	The Caribbean Water and Wastewater Association	Operations Officer	Trinidad and Tobago
Valerie	Jenkinson	WWWS/OWB	CEO	Canada
Marc Hugo	Renaudin	DINEPA	Consultant du Genre dans le domaine de l'EAH	Haiti
soya	williams	Anguilla national Youth Council	Accountant	Anguilla
Bennie	Watson	University of the West Indies, Mona	Lecturer	Jamaica
Tiffany	van Ravenswaay	Ministry of Spatial Planning and Environment	Environmental Policy Officer	Suriname
Shelly-Ann	Cox	UWI-CERMES	Postdoctoral Research Associate	Barbados
Crystal	Wilson	Department of Environment	Project Assistant	Antigua and Barbuda
Suzanne	Joseph	Caribbean Water and Sewerage Association Inc	Program Officer	The United States
Khadia	Alfred-Francis	WASA	Engineer	Trinidad and Tobago
Amana	Hosten	GIZ Grenada	Technical Advisor	Grenada
Farzana	Leon	OECS	Technical Specialist	Saint Lucia
Donavan	Sankey	National Environment and Planning Agency	Applications Processing Officer Marine Biology	Jamaica
shenee	fuller	NEPA	Environmental Officer	Jamaica
Jahneil	Williams	National Environment and Planning Agency	Environmental Officer	Jamaica
Marina	Roberts	Environmental Management Authority	Environmental Programme Assistant	The United States
Lauren	Arendse	ICLEI Africa	Professional Services	South Africa
Sherifa	Cohen	Rural Water Supply Limited	Project Design Engineer	Jamaica

First Name	Last Name	Organisation	Job Title	Country
Laurenzo	Tirtopawiro	IICA	Technical Agriculture Innovation Specialist	Suriname
Naomi	Mendeszoon	ART	Water engineer	Suriname
Aicha	Chorak	FSTT-UAE	Researcher	Morocco
Marco	Audain	Central Water and Sewerage Authority	Engineer, Operations and Maintenance	Saint Vincent and the Grenadines
Trevor	Thompson	GWPC	Chair	Grenada
Ruth	Baptiste	COY16	Country Coordinator	Trinidad and Tobago
Seon	Raymond	Ministry of Public Utilities	Senior Research Analyst	Trinidad and Tobago
Deanesh	Ramsewak	The University of Trinidad and Tobago - Centre for Maritime and Ocean Studies	Assistant Professor in Practice	Trinidad and Tobago
Christie	Vernon	Department of the Environment	Environmental Technician	Belize
Dizzanne	Billy	Climate Tracker	Communications and Outreach Manager	Trinidad and Tobago
Tonia	Williams	Environmental Protection Department	Marine Pollution Officer	Barbados
Ainhoa	Mingolarra	University	Universidad	Spain
Kareina	St. Hill	KCL	Researcher	Trinidad and Tobago
Delsy	Marecos	AIDIS PARAGUAY	AIdis joven	Paraguay
Bridget	Blake	NWC	Environmental Analyst	Jamaica
Hema	Roopnarine	COSTAATT	Senior Lecturer	Trinidad and Tobago
Hannah	Carty	VI Department of Agriculture	Deputy Commissioner	The United States
Eugenio	Barrios	UNEP	Consultant	Mexico
Barton	Clarke	CARDI	Executive Director	Trinidad and Tobago
Glaister	Cunningham	National Water Commission	VP Investment & Performance Monitoring	Jamaica
Jamekal	Andwele	Barbados Agricultural Development and Marketing Corporation	Manager	The United States
Kevon	Rhiney	Rutgers University	Assistant Professor	The United States
Christianne	Zakour	University of the West Indies	Student	Trinidad and Tobago
Paco	Smith	Innovative Paradigm Insights	Independent Development Consultant	Belize

First Name	Last Name	Organisation	Job Title	Country
Danneille	Townsend	NA	Graduate	The Netherlands
Tania	Khan	St. George's University	Student	The United States
Marissa	Auguste	University of the West Indies	Student	Saint Lucia
Peter	Hewitt	St. Catherine Municipal Corporation	Senior Compliance Officer/Special Projects Coordinator	Jamaica
Sean	Gloumeau	Crossover for Work	Software Engineer	Barbados
Kelly-Ann	Knight	Ambev	Safety & Environment Manager	Barbados
Marissa	Mc Millan	WRA/WASA	Watershed Planner	Trinidad and Tobago
Fritz	Onezy	Organisation de recherches et de standards adaptés (ORSA)	CEO	Haiti
KEMAR	PEART	HEART TRUST NSTA	Assessment Monitoring Officer	Jamaica
Michael	Dalton	Inter-American Institute for Cooperation on Agriculture	Technical Specialist	Saint Vincent and the Grenadines
Nicolaas	Kersting	NFK Services Ltd.	Coastal & River Engineer	Trinidad and Tobago
Elvira	Segura	INAPA	Gestión Ambiental y Riesgos	The Dominican Republic
Jeremy	Mendes	Grenada Bureau of Standards	Technical Officer	Grenada
Susanna	Keim	UNEP Cartagena Convention Secretariat	Individual Contractor	Germany
Anita	Montoute	Sustainable development	Permanent secretary	Saint Lucia
Magnus	Williams	Dominica Water and Sewerage Company	Chief Engineer	Dominica
Robert	Crowley	RWC Technologies SRL	CEO	The United States
Maria	Foulquie	Visuality	Graphic Recorder	Belgium
Keisuke	Sasaki	Iadb	Water specialist	The United States
Jamilla	Sealy	Caribbean Youth Environment Network	Member of the Regional Steering Committee	Barbados
Arianna	Numi	Independent consultant	Environmental Engineer	France
carlton	wedderburn	Agriculture	Director, Economic Planning	Jamaica
Dwayne	Squires	Caribbean Development Bank	Operations Officer	Barbados

First Name	Last Name	Organisation	Job Title	Country
Miguel	Montoute	Water Resources Management Agency	Water Resources Specialist	Saint Lucia
Alex	Harewood	Caribbean Community Climate Change Center	Project Engineer	Barbados
Shaunelle	Valley	Quabicon	Quality Assurance Manager	Canada
Arpita	Mandal	University of The West Indies. Mona.	Senior Lecturer	Jamaica
Martin	Forde	St. George's University	Professor	The United States
Sophie	Klien	Caribbean Youth Environment Network (Saint Lucia) / COY16 Country Coordinator (Saint Lucia)	Member/Country Coordinator	Saint Lucia
Claudia Cecilia	Joya	UNAH VS	Coordinador de Grupo de Investigacion	Honduras
Regina	Selman Moore	Barbados Advocate	Journalist	Barbados
Kadijah	Edwards	GEF Small Grants Program Grenada	National Coordinator	Grenada
Mihiri	Bogollagama	St George's University	Student	Grenada
Natalee	Hutchings	Water Resources Authority	Assistant Hydrogeologist	Jamaica
Rianna	Gonzales	Global Water Partnership	Youth Engagement Specialist	Sweden
Miguette	Dorné	FLM	Officier PH	Haiti
Carlos	Saavedra	GIZ	NDC Senior Advisor	Bolivia
Khadija	Robert	Ministry of Public Utilities	Secretary	Trinidad and Tobago
Adam	Snyder	The Nature Conservancy	Conservation Campaigns Manager	The United States
Melissa	Curtis	UWI, Mona	Postgraduate	Jamaica
David	Farrell	Caribbean Institute for Meteorology and Hydrology	Principal	Barbados
SHANMATIE	PERSAD	EMA	Environmental investigator	Trinidad and Tobago
Carlinton	Burrell	Caribbean Climate Innovation Center	Chief Executive Director	The United Kingdom
Nicholas	Fields	Independent	Climate Change Professional	Barbados
Indira	James-Henry	Ministry of Health, Wellness and the Environment	Environment Implementation Coordinator	Antigua and Barbuda

First Name	Last Name	Organisation	Job Title	Country
George	Woolhouse	HR Wallingford	Principal Scientist	The United Kingdom
Monifa	Blake	Ministry of Transport and Mining	Environment Officer	Jamaica
Fredericka	Deare	Kairi Consultants Limited	Principal Consultant	Trinidad and Tobago
MARJORIE	SEGREE	UTECH	LECTURER	Jamaica
Luciana Raquel	Verastegui Moncada	Ocean's Voice	Coordinatos	Mexico
Vaughn-Xavier	Jameer	Student Energy, COY16	Community Coordinator, Regional Coordinator for the Caribbean	Trinidad and Tobago
Deidre	Burgher	NEPA	Applications Processing Officer/Chemical Engineer	Jamaica
Tahira	Khan	NIHERST	Research Assistant I	Trinidad and Tobago
Arlene	Laing	Caribbean Meteorological Organization Headquarters	Coordinating Director	Trinidad and Tobago
Ryan	Mahadeo	N/A	N/A	Trinidad and Tobago
Kimeka	Lewis	Imperial optical	Optician	Jamaica
Natalya	Nurse	CCCCC	Field Engineer	Barbados
Robert	Miller	National Irrigation Commission Limited	Regional System Manager	Jamaica
Audra	Francis-Smith	Adopt a River TT	Outreach Officer	Trinidad and Tobago
Sterling	James	The University of The West Indies	Student	Trinidad and Tobago
Nishana	Ramsawak	Queens University, PhD candidate	Civil Engineering, PhD Candidate	Trinidad and Tobago
Dino Clayde	Demidof	IICA	Technical Team Leadert	Suriname
Glendon	Greenidge	Civil Defence Commission	Volunteer	Guyana
Pearl	Bergan	University of the West Indies	Research Student	Saint Kitts and Nevis
Kenaud	Ryan	Montserrat Utilities Limited	Manager Water & Waste Water Division	Montserrat
Ruth	Spencer	Marine Ecosystems Protected Areas (MEPA) Trust	Deputy Chair	Antigua and Barbuda
Curt	Delice	Inter-American Institute for	Special Affairs Coordinator for the	Suriname

First Name	Last Name	Organisation	Job Title	Country
		Cooperation on Agriculture (IICA)	Caribbean Region/Representative in Suriname	
Ancilleno	Davis	Science and Perspective	Owner/CEO	The Bahamas
Kaila	Clarke-Mendes	EMA	Research Assistant	Canada
Ivanira	Da Costa James	DOWASCO	Operations and Maintenance Manager	Dominica
Margaret	Christian	University of Technology, Jamaica	Special Projects & Training Manager	Jamaica
Carey	Adams	Caribbean Youth Environment Network	IT Administrator	Guyana
Neri	James	Environmental Health Division	Chief Environmental Health Officer	Saint Vincent and the Grenadines
Ciaretta	Profas	Government of Curacao -Ministry of Health, Environment and Nature	Policy Advisor - Environment & Nature	Curaçao
Lea	Bristol	The Willow Foundation	Clerk Typist 1	Trinidad and Tobago
Gergana	Majercakova	GWP	Sr Learning Specialist	Slovakia
Anne	Desrochers	FAO	National Programme Consultant	Barbados
Leanne	Archer	University of Bristol	PhD student	The United Kingdom
Monika	Ericson	Global Water Partnership (GWP)	Senior Communications Specialist	Sweden
Anik	Jarvis	Department of Environment	GIS Apprentice	Antigua and Barbuda
Abiodun	Ogunyemi	The Achievers Gathering	Assistant Director	Nigeria
Karla	Utting	TNC	EC	The United States
Davon	Baker	Kipaji Development Initiative, Inc.	President	Grenada
Lillieth	Clarke	CASE	Lecturer	Jamaica
Lisa	James	Oecs	Project officer	Saint Lucia
Alan	Marshall	Azure CleanTech Developments Jamaica Ltd.	Chairman	Jamaica
Eric	Wijngaarde	GEF/ SGP SURINAME	National Coordinator	Suriname
JUDIAN	MAYE	CASE	Lecturer/ Veterinarian	Jamaica
Mackenson	Cineus	Angajman	Director	Haiti
Lacramioara	Stroe Ziegler	GIZ	Project Manager	Germany
John	Agard	The University of the West Indies	Professor	Trinidad and Tobago

First Name	Last Name	Organisation	Job Title	Country
Elizabeth	Samuel-Howe	Water and Sewerage Authority	Economist/Project Analyst	Trinidad and Tobago
Théophilo	JARBATH	Ecole des Hautes Études en Sciences Sociales et Université d'Ottawa	doctorant et PhD student	Haiti
Isabela	Espindola	GWP	intern	Brazil
Ariel	Stolz	University of the Virgin Islands	Research Scientist	The Virgin Islands (U.S.)
Dario	Soto Abril	GWPO	CEO/Executive Secretary	Sweden
Corina	Piaggio	GWP	Communications Officer	Uruguay
Le-Anne	Roper	Min. of Housing, Urban Renewal, Env. and Climate Change	Senior Technical Officer (Adaptation)	Jamaica
Michael	White	Hydrology Consultants ltd	Managing Director	Jamaica
Martial	ATSÉ	African Network of Young Researchers	President	Côte d'Ivoire
Sukarni	Mitro	Meteorological Service	Head	Suriname
Simon	Stiell	Government Of Grenada	Minister - Climate Resilience and the Environment	Grenada
Pedro	Moreo Mir	OAS	GEF CReW+ Regional Coordinator	Mexico
Guilherme	Monteiro	IHE - Institute for Water Education	MSc Student	The Netherlands
Alan	Fryar	University of Kentucky	Professor	The United States
David	JORDAN	FRIEETAD in the OECS Inc	CHAIRMAN	Saint Lucia
nathaniel	castillo	ARI	Tech Specialist	Belize
Shonice	Warner	SJW inc	Attorney	Barbados
Marsha	Allen	Umass Geosciences	PhD candidate	The United States
Siddiqua	Mondol	Ministry of Tourism, Culture and the Arts	Tourism Advisor	Trinidad and Tobago
Waynelle	Collymore-Taylor	FAO	Technical Assistant	Barbados
Alice	Brandt	GIZ	Advisor	Germany
Humberto	Stepanik	Ministerio de Salud de la Nación	Especialista ASH	Argentina
Kerian	Ferreira	The Climate Change Institute	Director	Trinidad and Tobago
Christopher	McDonald	UVI	Researcher	The United States

First Name	Last Name	Organisation	Job Title	Country
Tennielle	Hendy	Ministry of Natural Resources, Mining and Petroleum	Principal Hydrologist	Belize
Jobel	Villafane-Pagan	University of Puerto Rico, Mayaguez Campus	Undergraduate Geology student	Puerto Rico
Aubrey	Roberts	Guyana Water Inc	Executive Director	Guyana
Curmira	Gulston	ODPM	Hazard Mitigation Specialist	Trinidad and Tobago
Atef	Soliman	Gatef organizations	Engineer	Egypt
Ronaldo	Blake	UWI, Mona	Student	Jamaica
premanie		RENA	Analyst	The United States
Paulette	Bynoe	University of Guyana	Senior Lecturer	Guyana
Joel	Coats	N.V Surinaamsche Waterleiding Maatschappij	Watertreatment specialist	Suriname
Rachel	Ramdin	Staatsolie	Exploration Geologist	Suriname
kelvin	Frith	Tobago House of Assembly	Monitoring and Evaluation Officer	Trinidad and Tobago
Ramon	Frutos	Galen University		
Esther	Chong Ling	ECLAC	Team Assistant	Trinidad and Tobago
Christina	Chanes	UVI	Research Specialist	The United States
Kambiri	Cox	International Water Association	Manager	The United Kingdom
Christopher	Corbin	UNEP Secretariat to the Cartagena Convention	Programme Manager, Pollution and Communications	Jamaica
Glenn	Amory	Ministry of Public Infrastructure	Senior Assistant Secretary	Saint Kitts and Nevis
Denise	Simmons	University of Guyana	Lecturer	Guyana
Sabrina	Compton	St. George's University	Instructor	Grenada
William	Lherisson	OPIDDE	Responsable de communication	Haiti
Rathna	Kewal	ministry of Spatial Planning and Environment	Sr.Policy Officer	Suriname
Shanell	Cyrus	Not Applicable	Environmental engineering student	Grenada
Latoya	Jackson-Morgan	National Water Commission	AVP- Project Management Office	Jamaica
Yumiko	Yasuda	Global water partnership	senior network and transboundary water cooperation specialist	Sweden
Kester	Craig	Civil Defence Commission	Director General	Guyana
Shazara	Ali	Coastal Dynamics Limited	Environmental Scientist	Trinidad and Tobago

First Name	Last Name	Organisation	Job Title	Country
Adrian	Mitchell	TT Ecological Services Limited	Director	Trinidad and Tobago
Diana	Collingwood	USVI Department of Agriculture	Assistant Commissioner	The United States
Debbie-Ann	Gordon-Smith	The University of the West Indies	Lecturer	Jamaica
Justin	Yearwood	Environmental Protection Department	Environmental Technical Officer (ag)	Barbados
Kemba	Jaramogi	Fondes Amandes Community Reforestation Project	Technical Director	Trinidad and Tobago
Erin	Jordan	Water Youth Network	Young Water Professional	The Netherlands
Garraway		Civil Defence Commission	Duty Officer	Guyana
Karl	Payne	CERMES- UWI Cavehill	Lecturer-Water Resources Management	Barbados
Omaira Avila Rostant - CARDI Belize		CARDI	Country Representative	Belize
Michael	Taylor	UWI	Professor	Jamaica
Florent Panny	Djeukoua Mbiadjeu	AIESEC	Patnership Developement Manager	Cameroon
Neranda	Maurice-George	GCF	Regional Consultant-Caribbean)	The United States
Terrisha	Walcott	St. George's University	Laboratory Technician	Grenada
Gem	Thomas	UWI	Researcher	Grenada
Betzaida	Ortiz	University of Puerto Rico	Graduate Student	Puerto Rico
Mario	Bento	Caribbean Water Treatment Ltd.	Managing Director	Antigua and Barbuda
Olivia	Gittens	BADMC	Business Development	Barbados
Flavia	Moraes	University of Georgia	PhD candidate	The United States
Alphonsus	Daniel	Daniel and Daniel Engineering Inc	Managing Director	Grenada
Patricia	Turpin	Environment Tobago	Manager	Trinidad and Tobago
Kim	Newton-James	Caribbean Public Health Agency (CARPHA)	Technical Officer Chemicals and Solid Waste Management	The United States
DENISE	WOOLFORD	GUYANA WATER INCORPORATED	Manager, Water Resources and Climate Change Adaptation	Guyana

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Anthony	Mai	Department of the Environment	Senior Environmental Officer	Belize
Kendell	Vincent	Caribbean Regional Youth Council	Board Member Communications and Information	Trinidad and Tobago
Barry	Lovelace	Environment Tobago	Education Programme Coordinator	Trinidad and Tobago
Peta-Gay	Harris	University of West Indies	Student	Jamaica
Carlington	Darby	National Irrigation Commission Ltd	Snr work Superintendent	Jamaica
julius	Smith	environmental policy and planning division, ministry of planning and development	environmental biologist	Trinidad and Tobago
Maxene	Atis	The Nature Conservancy	Haiti Program Director	The United States
Paige	Bastian	Bahamas Development Bank	Project Administrator - Strategic Development & Initiatives	The Bahamas
Sauda	Roberts	Civil Defence Commission	Duty Office	Guyana
Anika	Sutherland Cole	GWP-C	Technical Sub Committee Member	Canada
Gabrielle	De Souza	Ministry of Agriculture, Land and Fisheries	Agricultural Officer	Trinidad and Tobago
Keith	Nichols	Caribbean Community Climate Change Centre	Head, Programme Development and Management Unit	Belize
Tracey	Edwards	Plakortis	Business Sustainability Expert	Jamaica
Orville	Grey	GCF	Regional Manager	Korea
Amrika	Maharaj	UWI	GRA	Trinidad and Tobago
Craig	Thomas	IICA	National Specialist	Antigua and Barbuda
Parris	Lyew-Ayee	Jamaica National Foundation	Chairman	Jamaica
Hyacinth	Douglas	UNDP/GEF SGP	National Coordinator	Jamaica
Hadasha	Buckmire	NTRC	Finance Manager/ Analyst	Grenada
Epafrodit	VERTY	HAITI SURVIE	Monitoring Officer	Haiti
Naviel	Lue	Department of Nature and Environment	Researcher	Aruba
Darron	James	The University of the West Indies	Student	Trinidad and Tobago

First Name	Last Name	Organisation	Job Title	Country
Lavina	Alexander	Government of Saint Lucia	Sustainable Development and Environment Officer	Saint Lucia
Neftalí	Calel	GIZ GT, Programa ADÁPTATE	Asesor en Agua y Saneamiento	Guatemala
Chandelle	O'Neil	Independent	Sustainable Energy Specialist/ Human Rights Advocate	Canada
Ronald	Roopnarine	University of the West Indies	Lecturer	The United States
Martina	Duncan	Food and Agriculture Organization	Natural Resources Officer	Barbados
Eva	Blässar	Global Water Partnership	Writer & Media Specialist	Sweden
elaine	hamilton	National Irrigation Commission Limited	Training & Development Coordinator	The United States
Claudia	Mauti	Nessuna	Laurea	Italy
David	Boutt	UMass-Amherst	Professor	The United States
Halla	Sahely	Environmental Consultant	IWEco National Project Coordinator for St. Kitts and Nevis	Saint Kitts and Nevis
Francesca	Marino	HR Wallingford	Graduate Scientist	The United Kingdom
Sharon	Jones	IICA	Technical Specialist	Saint Kitts and Nevis
Damion	Campbell	The Water Project Jamaica	Graphic Artist	Jamaica
Tamara	Heartsill-Scalley	International Institute of Tropical Forestry, USDA Forest Service	Research Ecologist	Puerto Rico
Suelan	Chin	Environmental Management Authority	Environmental Investigator 1	The United States
Elon	Cadogan	Caribbean Community Climate Change Centre	Project Manager	Barbados
MARINA	YOUNG	Rural Agricultural Development Authority	Principal Director Technical Services	Jamaica
Jason	Barker	The National Environment and Planning Agency	Processing Officer - Marine Biologist	Jamaica
Marisa	Myburgh	Witteveen+ Bos	Hydraulic Engineer	The Netherlands
Vanessa	Budraj	University of the West Indies	Student	Trinidad and Tobago
Shannon	Samuda	JN Foundation	Communication Consultant	Jamaica

First Name	Last Name	Organisation	Job Title	Country
Tizian	Kümpel	GIZ	Intern	Germany
Odessa	De Barros	St. Rose's High School	Secretary	Guyana
Gregg	Anderson	Utility Regulation and Competition Office	Executive Director, Energy	The Cayman Islands
Jason	Ernest	Water Resources	Director	Saint Lucia
Fayola	Blackwood	Disaster Management/Risk Reduction Consulting Firm	Chief Emergency Management Executive	The United States
Katharina	Schaaff	GIZ	Lead Finance GIZ-CreW+	Costa Rica
Sara	Oppenheimer	Global Water Partnership	Programme Specialist	Sweden
MCCLURE	SIMON	APUA	CS ENGINEER	Antigua and Barbuda
Kwame	Emmanuel	Centre for Environmental Management, UWI, Jamaica	Associate Lecturer	Jamaica
Sherwyn	Greenidge	Department of Environment	Local Area Plan Apprentice	Antigua and Barbuda
Kavita	Singh	WaterSpace Ltd.	Director	Trinidad and Tobago
Luther	Tyson	Water Resources Management Agency	Information Systems Manager	Saint Lucia
Rameez	Baksh	NCRHA	Statistical Officer	The United States
Carol-Anne	Blenman	Violeta Consulting Services	Founder, Economic Consultant	Barbados
Owen	Paul	Civil Defence Commission	Operations Supervisor	Guyana
Betsy	Bandy	Ministry of Science, Energy and Technology	Director, Renewable Energy	Jamaica
Wendy	Smith	National Water Commission	Research and Development Manager	Jamaica
Uton	Henry	Unesco IHE	Hydrogeologist	The Netherlands
Benedict	Peters	National Disaster Management Agency	Coordinator	Grenada
Sabela	Pan	Acción contra el Hambre	Flying WASH adviser	Spain
Kadelle	Jessamy	Port of Spain City Corporation	Principal Medical Officer of Health	Trinidad and Tobago
Ramgopaul	Roop	Ro-Crops Agrotec	CEO and Manager	Trinidad and Tobago

First Name	Last Name	Organisation	Job Title	Country
ALICE	PROVIDENCE	MOH	Manager	The Turks and Caicos Islands
Nikita	La Cruz	Hydrometeorological Service	Hydro-Chemist	Guyana
CATHERINE	BELLAS	My Plant Center And Supplies	Ower	Trinidad and Tobago
Domenica	Villena	CITA UTEC	Analista	Spain
Kerry	Mitchell	St. George's University	Professor	Grenada
Maxine	Brown	NIC	Manager, Strategic Planning	Jamaica
Cornelius	Isaac	OECS	Program Specialist	Saint Lucia
Michelle	Shah	Ministry of Agriculture, Land and Fisheries	Agricultural Engineer	Trinidad and Tobago
David	Wilk	Consultant	Consultant	The United States
Carlston	Jobe	National Telecommunications Regulatory Commission	Assistant Telecommunications Engineer	Grenada
Aisha	Bedasse Jureidini	National Environment and Planning Agency	Manager, Applications Processing Branch	Jamaica
Evan	Cayetano	Inter-American Development Bank	Water and Sanitation Sp	Jamaica
andy	phillip	WEPCO LTD	DIRECTOR	The United States
Dr. Martin	Eduvie	National Water Resources Institute	Chief Lecturer	Nigeria
Md.Ilias	Miah	Centre for Environment, Human Rights & Development Forum -CEHRDF	CEO	Bangladesh
Jonathan	Drewry	PAHO	Advisor	The United States
Ramchand	Jailal	Guyana Water Incorporated	Executive Director Hinterland Services	Guyana
Alexander	Herrera	Fluence Corporation	Sales Manager	The United States
Gregg	Rawlins	Inter-American Institute for Cooperation on Agriculture	Representative in the Eastern Caribbean States	Saint Lucia
Yasa Belmar (St. Vincent and the Grenadines)		Sustainable Development Unit	Environmental Resource Analyst II	Saint Vincent and the Grenadines
Glenmore	Young	National Irrigation Commission Limited	Regional Systems Manager	Jamaica

First Name	Last Name	Organisation	Job Title	Country
Vincent	Sweeney	UNEP	Head, Caribbean Sub-Regional Office	Jamaica
Anton	Driz	IsraAID	Global WASH Advisor	Israel
Jay	Liebowitz	Seton Hall University	Visiting Professor	The United States
Celia	Edwards	Ministry of Agriculture, Lands and Forestry- Land Use Division/Irrigation Management Unit	Irrigation Technician	Grenada
MARK	CUMMINS	Ministry of Transport, Works and Water Resources	Permanent Secretary	Barbados
Valenton	Wint	V W INVESTMENTS company limited	Managing director	Jamaica
Kegan	Farrick	The University of the West Indies	Lecturer	Trinidad and Tobago
Cheryl SG	Rush	Chantilly Estate	Owner/Consultant	The United States
Paul	Hinds	Seneca College	Professor	Canada
Marion	Geiss	GIZ	Deputy Head of Project G-CREWS	Grenada
coreen	fiffee	volunteer crop-civil defense commission	'-	Guyana
Nadine	McFarlane	C.A.S.E.	Lecturer	Jamaica
Arabelle	James-Anglies	Caribbean Youth Environment Network	National Coordinator	Barbados
Adrian	Cashman	GWP TEC	Consultant	Barbados
Elisha	Bridgemohan	The University of the West Indies	Senior Secretary	Trinidad and Tobago
Simone	Lewis	GWP-C	Regional Coordinator	Grenada
James	Fletcher	SOLORICON	Managing Director	Saint Lucia
Janeil	Johnston	Government	GIS Officer	Antigua and Barbuda
Lauren	Mancewicz	Michigan Technological University	PhD Candidate	The United States
Donneil	Cain	CCCCC	Project Development Specialist	Belize
donna	blake	The Nature Conservancy	Jamaica Programme Director	Jamaica
ANTONIO RAMSES	MORALES JIMENEZ	CAF, DEVELOPMENT BANK OF LATIN AMERICA	SENIOR WATER AND SANITATION EXPERT	Peru
Kareem	Sabir	Caribbean Community (CARICOM) Secretariat	Senior Project Officer	Guyana

First Name	Last Name	Organisation	Job Title	Country
Bethia	Thomas	Department of Sustainable Dvelopment	Science and Technology Officer	Saint Lucia
Gillian	Stanislaus	Environmental Management Authority	Environmental Programme Officer II	Trinidad and Tobago
Chaney	St Martin	IICA	Technical Specialist in Water and Soil Management and Climate Innovation	Trinidad and Tobago
Sherry	Dumas-Harewood	CWWA	Trustee and Past President	Trinidad and Tobago
Persis	Ramírez	GWP-C	Program Officer	The Dominican Republic
Glenn	Marshall	Soil Conservation Unit, Ministry of Agriculture	Senior Agricultural Officer	Barbados
Jewel	Fredericks	Hydrometeorological Service	Hydrological Technician	Guyana
Lakeram	Singh	Caribbean Youth Environment Network	Deputy National Coordinator	Guyana
Akilah	Stewart	The University of the West Indies	Student/Part time Research Assistant	Trinidad and Tobago
junior	mathurin	Water Resources management Agency	Field Scientist	Saint Lucia
Josiena	CHOKATTE	Trend Setters	Product development and design	Sri Lanka
Derionne	Edmeade	Ministry of Environment	Environmental Education Officer	Saint Kitts and Nevis
Claudia Estrella	Prieto Mulattieri	Técnica en Gestión de Recursos Naturales y Desarrollo Sustentable	Técnica en Gestión de Recursos Naturales y Desarrollo Sustentable	Uruguay
Ann-Marie	Eversley	Environmental Protection Department	Senior Marine Pollution Officer	Barbados
Elizabeth	Thorne	ECLAC	Research Assistant	Trinidad and Tobago
Tamaju	Kitwana	Department of Environment	Research Assistant	Saint Kitts and Nevis
Awolorinke	Chiga Augustine	Kwame Nkrumah University of Science and Technology	Student	Ghana
Ryan	Rowe	HANWASH	Executive Director	Canada
Marlene	Power	Marine Institute	International Program Officer	Canada
Sanjay	Richardson	WRMA	Water Resources Officer	Saint Lucia

First Name	Last Name	Organisation	Job Title	Country
wayne	williams	CWWA	Executive Director	Trinidad and Tobago
Omar	Wright	JN Foundation	Finance and Administration Officer	Jamaica
Tom	Stadelmann	GIZ	Intern	Germany
Trina	Halfhide	the University of the West Indies	Lecturer	Trinidad and Tobago
Lucan	Francis	Lucan Francis/CRMS	Consultant	Saint Lucia
Ignatius	Jean	CAWASA	Executive Director	Saint Lucia
Adele	Young	IHE-Delft	PhD Fellow	Trinidad and Tobago
Samanthia	Justin	Department of Sustainable Development	Chief Technical Officer	Saint Lucia
Tameka	Deare	Kairi Consultants Limited	Consultant/Data analyst	Canada
Roxanne	Graham	St. George's University	Instructor	Grenada
James	Fletcher	SOLORICON	Managing Director	The United States

Appendix B – Agenda

Global Water Partnership Caribbean

EVENT AGENDA

• DAY 1 • MARCH 23, 2021 •

09:00 AM – 09:30 AM	**Opening Ceremony** **Welcome Remarks** Ms. Simone Lewis *Regional Coordinator GWP-C* **Opening Remarks** Mr. Trevor Thompson *Chair of Regional Chairs & Chair of GWP-C* **Brief Remarks** Dr. Kevon Rhiney *Chair of GWP-C Technical Committee* **Feature Address** *Senator the Honorable Simon Stiell* *Minister responsible for Climate Resilience and the Environment - Grenada*
09:30 AM – 09:45 AM	**Keynote Presentation** Professor Michael Taylor *Dean of the Faculty of Science and Technology* *The University of the West Indies (UWI) Mona Campus*
09:45 AM – 09:50 AM	**Icebreaker Session**
09:50 AM – 10:55 AM	**Paper Session 1** Water Security & Climate Change I
10:55 AM – 11:05 AM	**Coffee Break**
11:05 AM – 12:25 PM	**Session** Bridging the science/policy divide
12:25 PM – 12:30 PM	**Closing of Day 1**

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Global Water Partnership Caribbean

EVENT AGENDA

• DAY 2 • MARCH 24, 2021 •

09:00 AM – 09:20 AM	**Greetings & Overview** **Welcome Remarks** Mr. Dario Soto-Abril *Executive Secretary, Global Water Partnership (GWP)*
09:20 AM – 09:35 AM	**Keynote Presentation** Ms. Rianna Gonzales *Youth Engagement Specialist at GWP*
09:35 AM – 09:40 AM	**Icebreaker Session**
09:40 AM – 10:40 AM	**Young Caribbean Water Entrepreneurs** Shark Tank Session & Round Table Discussion Youth & Gender
10:40 AM – 11:45 AM	**Coffee Break**
10:45 AM – 11:45 AM	**Paper Session 2** Water Security & Climate Change II
11:45 PM – 12:25 PM	**Paper Session 3** Resilience
12:25 PM – 12:30 PM	**Closing of Day 2**

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EVENT AGENDA

• DAY 3 • MARCH 25, 2021 •

09:00 AM – 09:10 AM	**Greetings and Overview** **Icebreaker session**
09:10 AM – 10:10 AM	**Paper Session 4** Public Health & Water Quality
10:10 AM – 10:20 AM	**Coffee Break**
10:20 AM – 11:00 AM	**Presentations and Round Table Discussion** Wastewater Management
11:00 AM – 12:15 PM	**Moderated Session** Time to take a regional approach to Integrated Water Resources Management (IWRM)
12:15 AM – 12:30 PM	**Wrap up Session** Closing Remarks and next steps GWP-C

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