Report

Rainwater Harvesting (RWH) Knowledge Network Forum

21st- 23rd. October 2014

Bay Gardens Inn

Saint Lucia

Organising partners:

Global Environment Facility International Waters Learning Exchange and Resource Network (GEF-IW:LEARN) | Global Water Partnership-Caribbean (GWP-C) | Global Environment Facility (GEF) Amazon Project |Caribbean Aqua-Terrestrial Solutions (CATS) funded by the German Federal Ministry for Economic Cooperation and Development (BMZ) through the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH | the Environmental Health & Sustainable Development Dept, Caribbean Public Health Agency (CARPHA)

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List of acronyms

Acronyms of organisations and programmes

Acronym	Organisation / Programme
BMZ	German Federal Ministry for Economic Cooperation and Development
CARPHA	Caribbean Public Health Agency
CATS	Caribbean Aqua-Terrestrial Solutions
CAWASA	Caribbean Water and Sewerage Association Inc.
CCCCC / 5Cs	Caribbean Community Climate Change Centre
CCST	Caribbean Council for Science and Technology
CDB	Caribbean Development Bank
CEHI	Caribbean Environmental Health Institute
CEHP	Caribbean Eco-Health Programme
CERMES	Centre for Resource Management and Environmental Studies
COTED	Council for Trade and Economic Development
CWWA	Caribbean Water and Wastewater Association
FAO	Food and Agricultural Organization of the United Nations
GEF	Global Environment Facility
GEF-IWCAM	Global Environment Facility Integrating Watershed & Coastal Areas Management in Caribbean SIDS
GEF IW:LEARN	Global Environment Facility International Waters Learning Exchange & Resource Network
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GWP-C	Global Water Partnership-Caribbean
GWP-CAM	Global Water Partnership-Central America
GWP-Med	Global Water Partnership-Mediterranean

IICA	Inter-American Institute for Cooperation on Agriculture
NIHERST	National Institute for Higher Education, Research, Science and Technology, Trinidad and Tobago
NWSC	National Water and Sewerage Commission, Saint Lucia
OECS	Organisation of Eastern Caribbean States
RRACC	Reduce Risks to Human & Natural Assets Resulting from Climate Change
TMR	Trust for the Management of Rivers, Saint Lucia
UNEP	United Nations Environment Programme
UNEP Car/RCU	United Nations Environment Programme Caribbean Regional Coordinating Unit
UWI	University of the West Indies
WACDEP	Water, Climate and Development Programme
WASCO	Water & Sewerage Company of Saint Lucia
WHO	World Health Organization
WRA	Water Resource Authority, Jamaica
WRRI	Water Resources Research Institute, US Virgin Islands

Other acronyms

Acronym	**Detailed description**
BVI	British Virgin Islands
IWRM	Integrated Water Resources Management
NCWR	Non-Conventional Water Resources
MDGs	Millennium Development Goals
MOU	Memorandum of Understanding
RWH	Rainwater Harvesting
SIDS	Small Island Developing States
USVI	US Virgin Islands

Executive Summary

The Caribbean Public Health Agency (CARPHA) in collaboration with the Global Water Partnership-Caribbean (GWP-C), the Global Environment Facility (GEF) Amazon Project, the Global Environment Facility International Waters Learning Exchange & Resource Network (GEF-IW:LEARN), the Caribbean Aqua-Terrestrial Solutions (CATS) funded by the German Federal Ministry of Economic Cooperation and Development (BMZ), and the United Nations Environment Programme Caribbean Regional Coordinating Unit (UNEP Car/RCU), convened the **Rainwater Harvesting (RWH) Knowledge Network Forum,** which was held in Saint Lucia at the Bay Gardens Inn from 21st -23rd October, 2014.

The main purpose of the forum was to share knowledge, research, and good practices on RWH systems as a means of providing decision-makers with adequate models of RWH systems that promote access to safe water supply. In addition, the forum sought to update the document "A Programme for Promoting Rainwater Harvesting in the Caribbean Region", which was developed by the Caribbean Environmental Health Institute (CEHI, now CARPHA) in collaboration with the United Nations Environment Programme (UNEP) in 2006. The regional programme in this document comprises four major strategic areas: (1) Awareness Raising, (2) Capacity Building, (3) Legislative and Policy Formulation and (4) Infrastructural Development with objectives and key actions detailed for each strategic area. This came about after almost a decade of consultations on water resources management in the Caribbean, following Hurricanes Ivan and Emily in Grenada (out of which they developed a national RWH plan); this raised awareness for the need for RWH systems in the region.

A total of 50 participants attended the forum. This included 8 regional and 4 international organisations, representatives of water organisations, engineers, government ministries, and representatives from the private sector. The regional and international agencies included the University of the West Indies (UWI), Organisation of Eastern Caribbean States (OECS), the Caribbean Public Health Agency (CARPHA), the Caribbean Community Climate Change Centre (CCCCC), the Caribbean Council for Science and Technology (CCST), the Caribbean Water and Sewerage Association Inc. (CAWASA), GWP-C, the Global Water Partnership-Central America (GWP-CAM), and the Caribbean Water and Wastewater Association (CWWA). The international agencies included the Food and Agricultural Organization of the United Nations (FAO), UNEP, and the Global Water Partnership-Mediterranean (GWP-Med).

Based on the deliberations of the forum, these were the **key findings and recommendations:**

- RWH systems should be designed for the people who are using them, especially women and vulnerable groups.
- There is a need for a strong awareness programme on RWH, particularly aimed at schools.
- Local knowledge should be used in rainwater management.

- RWH projects need to factor in the various players, such as technical professionals, business people, and politicians who all have different objectives. The key is to work together for the benefit of the community.
- The need for more coordination by a lead regional agency that takes ownership and has the legitimacy to champion advocacy and implementation of RWH initiatives across the Caribbean has emerged. There was also a call for a coordinated approach among regional agencies.
- The need to target policy leaders, especially technocrats in the Ministries of Finance and politicians, for the implementation of RWH systems was highlighted. Policy makers should be brought into the communities that rely on RWH for everyday use.
- Reaching out to consumer groups, households, the Ministry of Gender Affairs, Village Councils and the main users of RWH and consulting with them at the planning stage is of great importance.
- Taking a more strategic approach to RWH by producing a work plan that identifies a few key things that can be done and implemented on a step by step basis is necessary. This should be underpinned by research, making use of new information, and leveraging social media and other telecommunications tools.
- There is a need to consider incremental implementation of RWH systems, possibly sector by sector, for example, beginning with the hotel sector, and focusing on the areas where most returns can be obtained. Emphasis should be placed on the revenue savings from RWH systems to households or communities, and not only storage.
- The recently developed OECS Water Resources Management Policy should be augmented to make very specific policy references to RWH within the scope of a water resources management strategy. RWH Policy issues need to be developed alongside an enabling environment for implementation of the policies.

The way forward was identified for follow-up by the Caribbean Public Health Agency (CARPHA):

- The formal ratification and endorsement of a lead regional agency for the promotion of a regional RWH strategy;
- Gaining recognition at the regional level through the Council for Trade and Economic Development (COTED) - agriculture, environment, health; and to post Millennium Development Goals (MDGs) development agenda;
- The establishment of partnership arrangements with relevant Caribbean agencies to strengthen outreach and advocacy efforts; assistance with resource mobilisation in the execution of various components of the regional strategy;
- The facilitation of joint Memorandums of Understanding (MOUs) among agencies to foster south-south cooperation;
- Updating existing websites for the capture and dissemination of best practices in RWH; and

- The promotion of RWH through existing regional initiatives, for example, through integration with the irrigation support components of the regional FAO School Feeding and School Gardening programmes.

Background

Promoting access to safe and reliable sources of water still remains a development priority in the Caribbean. Significant improvements have been made through the establishment of centralised municipal water supply systems, which provide water to the majority of households and businesses.

Although RWH techniques have been used in many parts of the world, they have not been formally included as part of water resources management policies as has been done for ground and surface water. Over the last eight years, programmes have been developed at the regional level to promote the adoption of RWH practices and to mainstream strategies that facilitate their adoption into wider water sector policies in the region. These included initiatives such as the Global Environment Facility Integrating Watershed & Coastal Areas Management in Caribbean Small Island Developing States (GEF-IWCAM) project (2006-2011*)* and the regional project undertaken by CEHI, (now CARPHA) in collaboration with UNEP entitled "A Programme for Promoting Rainwater Harvesting in the Caribbean Region".

Building on these initiatives, CARPHA in collaboration with GWP-C, the GEF Amazon Project, GEF-IW:LEARN, CATS, and UNEP Car/RCU convened the Rainwater Harvesting (RWH) Knowledge Network Forum with a common goal of exchanging knowledge and sharing best practices on RWH in the Caribbean region and updating the regional RWH programme to make it relevant to current and emerging issues, and to:

- Present practical experience and best appropriate technology in RWH to decision-makers from the public and private sector;
- Support targeted learning through structured discussions at expert level and discuss the requirements for a wide up-scaling improvement of RWH technologies in the Caribbean and Amazon region;
- Exchange technical, scientific, and socioeconomic experiences between the Amazonian and Caribbean partners; and
- Create interaction mechanisms that allow the expansion of knowledge concerning techniques and research on RWH systems in partner countries, in order to provide decision-makers with adequate practices and models of RWH systems that promote access to a safe water supply in Amazonian and Caribbean rural areas.

Rainwater Harvesting (RHW) Knowledge Network Forum

A total of 50 participants attended the forum, this included eight regional and four international organisations, representatives of water organisations, engineers, government ministries, and representatives from the private sector. The regional and international agencies included UWI, OECS, CARPHA, CCCCC, CCST, CAWASA, GWP-C, GWP-CAM, and CWWA. The international agencies included the FAO, UNEP, and GWP-Med.

Day 1 Proceedings

Opening Remarks

Dr. Christopher Cox, Caribbean Public Health Agency (CARPHA)

The forum began with brief opening remarks by Dr. Christopher Cox, head, Environmental Health & Sustainable Development Department, CARPHA, who chaired the proceedings. He welcomed all participants to Saint Lucia and noted the wide range of participants represented, including the private and public sectors, engineers, representatives from other regional agencies, and academia.

He highlighted the need for convening the Rainwater Harvesting Forum at this time and hoped that it would provide a platform for capturing and sharing knowledge and best practices among the participants and that it would build on the earlier initiative called "A Programme for Promoting Rainwater Harvesting in the Caribbean Region", as a way forward. He acknowledged the agencies responsible for organising the forum, namely the Environmental Health & Sustainable Development Department of CARPHA; GWP-C; the GEF Amazon Project representatives, who were unable to attend; GEF IW:LEARN, the CATS Programme; and UNEP Car/RCU.

Mr. Paul Hinds, Global Water Partnership-Caribbean (GWP-C)

Mr. Paul Hinds, Interim Coordinator of Global Water Partnership–Caribbean, in his short remarks, reiterated the commitment of the GWP-C in supporting Caribbean countries in the sustainable management of their water resources by fully promoting and applying Integrated Water Resources Management (IWRM) in the region. He indicated that the agency had collaborated with CEHI to develop a RWH project and directed participants to the resources on RWH that can be found on the GWP-C website (www.gwp-caribbean.org).

He noted that concerns such as climate change and gender issues, among others, are common across the sectors and that water resources management will become more important with the impact of climate change. He noted the prominence that has been given to storage and water safety issues and suggested that emphasis should also be given to the revenue savings to be derived from RWH to a household or community and asked the workshop to also focus on these aspects.

Mr. Christopher Corbin, United Nations Environment Programme Caribbean Regional Coordinating Unit (UNEP Car/RCU)

Mr. Christopher Corbin, representing UNEP, and on behalf of GEF-IW:LEARN, also extended a warm welcome to participants. He pointed to the long association of UNEP with early work on RWH and noted the work of the GEF-IWCAM Project in promoting RWH in the region.

He anticipated that the forum would provide an opportunity to share, learn, and provide ideas for the implementation of RWH systems. He looked forward to a "community of practice" coming out of the forum, especially given the wide range of participants. He noted that although RWH was the focus of this forum, water resources management was the broader issue.

Dr. Horst Vogel, Caribbean Aqua-Terrestrial Solution (CATS) Programme, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

Dr. Horst Vogel, representative of GIZ, spoke of the CATS Programme, which is comprised of two components: Adaptation to climate change in agriculture and forestry, and coastal resources management and conservation of marine biodiversity. He mentioned CATS activities in support of RWH in the region, making reference to lending support to a water loss reduction programme, which takes a regional approach, especially as pertains to water and energy, noting the high cost of energy associated with the pumping of water to reach end users. RWH may be a viable solution for offsetting energy costs related to water distribution.

With regards to the successful use of RWH and water conservation, he described the practice of RWH in Yemen where terracing is used within sophisticated water management schemes, which have been practiced for over 3,000 years.

My. Sylvester Clauzel, Permanent Secretary, Ministry of Sustainable Development, Saint Lucia

Mr. Sylvester Clauzel, Permanent Secretary, Ministry of Sustainable Development of Saint Lucia, began his opening remarks by welcoming participants. He alluded to issues in the water sector in Saint Lucia, especially related to the John Compton (Roseau) Dam, which was affected by heavy siltation with compromised ability to maintain a reliable supply of water to the northern part of the country, as was originally designed. This has affected both the local population and the tourism industry, both of which are mostly concentrated in the northern part of the island. He noted the frequency of extreme weather events due to climate change, which will have repercussions in terms of water security.

He also raised the issue of pollution of traditionally utilised spring sources in Saint Lucia, which are not subject to formal protection and water derived is not treated, constituting a potential

health risk. He mentioned new initiatives being pursued to deal with the siltation problem at the John Compton Dam, including the construction of two water collection, treatment and distribution plants - one at Dennery and the other at Vieux Fort, which are due for completion in 2017.

In addition, the Government of Saint Lucia was looking into recommissioning older water intakes, which would enable the Water & Sewerage Company of Saint Lucia (WASCO) to provide the additional 13,638.3 – 31,822.6 m^3 (3 - 7 million Imp. gal.) needed. He urged the Forum to look into costs associated with the cost-effective use of RWH, especially for dual plumbing and retrofitting, as such issues will inform the incentives that should be in place, including the possible tax rebates that would inform the policy framework and tax incentives for this initiative.

Presentations

Presentation: Overview of regional-level RWH efforts in the Caribbean: *A summary of past and current initiatives*

Presenter: Mrs. Norma Cherry-Fevrier, Organisation of Eastern Caribbean States (OECS) Commission

The presenter focused on the interventions that the Reduce Risks to Human & Natural Assets Resulting from Climate Change (RRACC) Project had undertaken in RWH in the OECS Member States. She highlighted the key reasons for investing in RWH, which included longer dry seasons and reductions in the length of the rainy season, resulting in changing rainfall patterns and more frequent occurrences of drought (due to climate change), particularly when water demand exceeds supply. She gave an overview of the RRACC project and its components. The project is a five-year project that ends in September 2015 and is funded by USAID in the amount of US$14.17 million, with the OECS Commission contributing US$ 1.1 million and OECS Member States contributing US$2.57 million in cash or in-kind, according to the grant agreement. The broad objective of the project is "to enhance the overall long-term capacity of the OECS region to respond to climate change, while strengthening the near-term resilience of Member States to climate change impacts, through concrete on-the-ground action". The four main components of the project were noted in Component 2, identifying water availability as a critical issue in the face of climate change. Therefore, the project embarked upon several RWH initiatives in OECS Member States as a means of assisting them in building resilience and adapting to climate change. These include the following:

- St. Vincent and the Grenadines: RWH systems were installed at six sites to mitigate against water shortages during and after climate events.
- Grenada: A 4.6 m^3 (1,000 Imp. gal.) tank was erected at the Forestry Nursery to improve water supply for the propagation of seedlings.
- Dominica: A ferro-cement tank with a capacity of 90.9 m^3 (20,000 Imp. gal.) was constructed in addition to five 4.6 m^3 (1,000 Imp. gal.) tanks on various buildings at the Londonderry Livestock Facility in order to assist the farm with meeting water demand for sanitation, irrigation, and consumption by livestock.
- Barbuda: A man-made water catchment and storage system is being constructed to support farming and reduce the threats of drought and decreasing water availability to the agricultural sector.

Presentation: Overview of regional-level RWH efforts in the Caribbean: *A summary of past and current initiative*

Presenter: Dr. Christopher Cox, Caribbean Public Health Agency (CARPHA)

Dr. Christopher Cox began by giving a historical background highlighting the experiences with RWH in the region and the partners that had worked with the sector. He noted that the initiative was rooted in the call for development of IWRM approaches at the national level that had come out of 13th Session on the Commission on Sustainable Development, which in the context of the Caribbean translates to enhancing water security. Following this, UNEP embarked on the initiative to promote RWH and facilitate the formation of a Rainwater Partnership within the region.

Similar projects were implemented in Asia, Africa, and Pacific Small Island Developing States (SIDS). He recalled the initial support to CEHI for a Caribbean Programme, using Grenada as the pilot, where the effects of Hurricane Ivan which helped illustrate the vulnerability and impact on water resources and sanitation in a small island state. Additionally, Grenada, Carriacou, and Petit Martinique collectively represent many of the water issues faced by several Caribbean SIDS. He indicated that this was followed over the years by additional support from UNEP, the GEF-IWCAM Project, GWP-C, and a research initiative on water safety and RWH under the Caribbean Eco-Health Programme (CEHP).

Dr. Cox discussed the various educational and research products that came out of the RWH programme. These included the publication "A Programme for Promoting Rainwater Harvesting in the Caribbean Region", as well as a handbook on RWH. Brochures and posters were also produced and distributed across the region. He noted the use of GIS-assisted approaches to estimate the RWH capture potential in Antigua and Grenada.

Dr. Christopher Cox pointed to installations in the Mabouya Valley (Saint Lucia) funded by the GEF-IWCAM Project, demonstrating how RWH can be done safely as well as rehabilitation of rainwater catchments in smaller islands with low rainfall such as Union island along with initiatives in Antigua and Barbuda. In addition, he alluded to training tools produced by the project, including a rainwater mobile display model that can be used for education, and a web–based tool kit for sharing knowledge on RWH in the Caribbean.

Dr. Cox presenting to the workshop participants. (Photo by G. Lee Look)

Barriers to RWH practices were identified, including a concern for mosquito breeding, the cost of guttering and storage, and the fact that stored rainwater is often not handled to minimise contamination (it was noted that in Saint Lucia 80 percent of stored rainwater tested was not safe for consumption according to World Health Organization [WHO] standards). He concluded by pointing to new initiatives, including awareness and training for mainstreaming RWH in the Caribbean.

Discussion:

- The discussion began with OECS representatives providing further detail on the ground catchment in Barbuda referred to in the presentation. It was explained that the rainwater catchment is built in an old quarry with water flowing from an old bench in the quarry. Water is pumped from the catchment, which holds 1,168.3 m^3 (257,000 Imp. gal.).
- There is a need for maximising large surface storage for RWH, as was done in Brazil, where a large rainwater catchment tank was built under a football field.
- The question of marine seepage with regards to RWH tanks built near the sea arose. An example from the Grenadines was highlighted. It was explained that the tanks were sealed and were in no danger from marine seepage.
- With respect to water safety, the need for guidelines for RWH was raised, particularly as it relates to pollution associated with roofing material. It was noted that the newer RWH systems constructed, which use modern roofing material such as “permaclad”, reduce the pollution issues associated with older material such as painted galvanize and shingles.
- Policy aspects of mainstreaming RWH: At the residential/domestic level, there should be more awareness building, convincing policy makers of the economic argument for RWH, especially if the water suppliers think that it will affect their revenue.
- The need for RWH should be seen as both, an augmentation and a public health issue, in terms of maintaining sanitation where primary supply becomes limited.
- The need to augment OECS Water Resources Management Policy to include RWH aspects was discussed. Revisiting RWH policy issues and developing an enabling environment for these policies is imperative.

Presentation: Climate Dimension of Water Resources

Presenter: Dr. Adrian Cashman, Centre for Resource Management and Environmental Studies (CERMES), University of the West Indies (Cave Hill)

Dr. Cashman began by reiterating the role of the Centre for Resource Management and Environmental Studies (CERMES) in training environmental professionals in order to improve the lives of the people they serve. With regards to water resources management, he emphasised the need for resilience, building redundancy in the system, and avoiding dependence on single sources, for example, as in the case of the John Compton Dam for the northern area of Saint Lucia. He underscored the need for messages on climate change to be rooted in people's experiences and noted that personal as well as moral incentives help change people's perceptions.

The presentation focused on the Caribbean climate outlook with respect to climate change, water security, and RWH around the following key considerations:

Changes in temperature: There will likely be an increase in the number of days and nights where temperatures exceed 35°C during the day and 25°C at night, and greater warming in the summer months than in the cooler, drier early months of the year.

Sea level rise: Forecasts range between 5 – 10 mm (0.2 – 0.4 inches) per year.

Rainfall: In the wet season, there will be a decrease of 30 percent in monthly precipitation in the northern Caribbean and a 20 percent decrease in the eastern Caribbean coupled with a decrease in rain days in the traditionally rainy season. The number of days of no rainfall will have implications for storage as well as cost. A 20 percent reduction in rainfall results in an increased storage capacity need by 30 percent.

Climate: Variability will force the need for an adaptation strategy as there will be need for more water storage, more sources and a need to cut wastage.

Water security: Water security was defined as "the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods." Four elements of water security include adequacy, accessibility, assurance and affordability. RWH is not only for domestic use, but can also make contributions to the economy in other areas, such as firefighting and irrigation, among others.

Challenges:

- The perception of state agencies that RWH is a backward move, RWH is not seen as an improved water supply;
- It is not addressed in water policies and has no legislation that will equate it with other forms of supply;
- May incur increased costs to the household in terms of installation and having to pump;
- There is a need for incentives to lessen the burden on the householder;
- There are health considerations with respect to RWH. What mechanisms will be put in place, such as regulations, to guarantee water safety?
- How can RWH be made into a viable adaptation measure and how should it be approached?

Discussion:

The ensuing discussion considered the following:

- RWH systems should be designed with the primary users in mind, for example the women who manage household supplies.
- RWH can be combined with a storm water management system to alleviate flooding issues (flood risk reduction).
- How far do you promote individual use and how do you regulate it and control quality?
- In Anguilla, every villa has a water supply. There was a need to see how this water storage works.
- With good technical protocols in place, rainwater supply will be safer, however, pollution could be introduced with use of dirty buckets and containers.
- RWH can be used for non-potable uses such as irrigation and firefighting, among other viable uses.

Presentation: Regional Experiences with RWH: Overview of driving issues for investment, achievements and challenges: The Grenadines

Presenter: Dr. Everson Peters, Department of Civil & Environmental Engineering, University of the West Indies (St. Augustine)

Dr. Peters explained that peoples' experience growing up in Carriacou with little water shaped their attitude towards RWH. He noted that in the Grenadines RWH was seen as a basic need. He advanced the view that RWH should be looked at as a business product and related how a great number of people who had migrated brought back rainwater systems. He said that in Carriacou, the issue is now one of water safety in terms of meeting international standards.

He compared water-related issues in Grenada and Carriacou, referring to data showing that Grenada had more health related issues despite its centralised water system.

He also looked at RWH per capita in various areas of Trinidad and Tobago and Grenada and saw a business opportunity for products, such as low volume toilets among others. On the supply side, he identified opportunities for the water company, such as metering to keep track of how much water people use and tracking leaks. The company could charge an additional fee for metering and for a standardised system for filters. Excess rainwater can be stored for use from an investment standpoint.

Clusters of wealthy hill-side dwellers could install communal RWH systems because they can afford to do so. In the case of low income groups, such as squatter communities, the government could provide a communal water supply.

Presentation: Regional Experiences with RWH: Overview of driving issues for investment, achievements and challenges: The US Virgin Islands

Presenter: Dr. Henry Smith, Water Resources Research Institute (WRRI), University of the Virgin Islands

Dr. Smith focused on the issues that drove the US Virgin Islands (USVI) to invest in RWH, these included:

- Cyclical rainfall, since the USVI only receive 1,270 mm (50 inches) of rain per year. The municipal water supply supplements the rainwater catchment. The soil is very thin and prone to salt water intrusion. In the past, sea water was used for street cleaning and firefighting. Most buildings have underground or second floor water supplies. He demonstrated various RWH systems, among these was a concrete hillside used as a water catchment.
- He indicated that in the USVI, cisterns are required by law, although this has changed over the years. Nevertheless, building permits still depend on your ability to show where the water supply was obtained. Storage requirements are $0.4 m^3/m^2$ (10 US gal. per sq. ft.).
- The public water system has not lessened the use of cisterns,
- Cisterns are built following best practices for material safety. There are also protocols for RWH. The cisterns should be cleaned occasionally (118 ml or 4 US oz. of chlorine per 3.8 m^3 or 1000 US gal. can be used). He concluded by stating that people use rainwater depending on their water conservation habits.

Discussion:

- In terms of water safety / water quality, people in the USVI boil water or use bottled water, especially for visitors.
- No studies have compared cistern water to public utility water supply in the USVI.

Presentation: Experiences with RWH: Overview of driving issues for investment, achievements and challenges: The Amazon Basin

Presenter: Dr. Norbert Fenzil, the Global Environment Facility (GEF) Amazon Project (via Skype)

The presenter shared some of the characteristics of the Amazon as they relate to RWH:

- The Amazon differs from the Caribbean in that it rains much more. There are also few safe water supply options within remote areas.
- Various RWH programmes have been implemented, including the Procuva programmes serving 12,500 people.
- There is no need to build very large tanks due to heavy rainfall.
- Rain is not the issue, but storage and filtration pose the biggest challenges; installation costs range from US$1,500 to US$2,500 per unit.
- He called for more cooperation and exchange of ideas and experiences with the English-speaking Caribbean.
- Dr. Norbert Fenzil shared information on the use of sand filters, which are relatively cheap and easy to install (see presentation in annex 4).

Presentation: Regional Experiences with RWH: Overview of driving issues for investment, achievements and challenges: Central America

Presenters: Rhona Diaz, Technical University of Panama

The presenter from Foundation Solar described it as a private developmental organisation in Guatemala concerned with water and energy programmes, environmental conservation, and capacity building within rural communities. She noted that although there is no legal framework for RWH and no specific water law, there are some regulations that prevent people from using water for profit. Water is seen as a human right, particularly for supporting agriculture.

Successes:

- Training provided in capacity building at the local level;
- Empowerment and sensitisation on the proper use of water; and
- Climate change mitigation and adaptation activities.

Challenges:

- High costs;
- No monitoring of the water availability and supply;
- In some cases, no training at all, causing the abandonment of the systems; and
- There are indigenous people's rights for 23 different tribes, resulting in regulations having to be adapted to each tribe.

RWH in Panama:

The presenter gave some background on Panama, which has an average annual rainfall of 1800 - 2000 mm (71-79 inches) and noted that the effects of climate change had resulted in an extended dry season. She indicated that 90 percent of the population has access to potable water but there is a high level of pollution of rivers.

Since government is focused on providing 100 percent of households with water, there is scope for the policy makers to include RWH in the mix. Currently, the Government provides a 1.88 m^3 (413.5 Imp. gal.) cistern for a family of five for only sanitation purposes. The project has cut-off the cost for pumps by locating tanks using the highest point of the house. She was of the view that politicians and policy makers can be shown the cost savings of using the roof tops in the urban areas for RWH. The use of commercial buildings for storage can also be evaluated using metadata to calculate the roof area available. She suggested installing RWH systems for sanitation in the schools and other public institutions.

Discussion:

- The community provided labour for the tank installations.

Presentation: Regional Experiences with RWH: Overview of driving issues for investment, achievements and challenges: The Mediterranean

Presenter: Konstania Toli, Global Water Partnership-Mediterranean (GWP-Med)

The presenter gave an overview of the RWH and Non-conventional Water Resources Programmes in the Mediterranean. Under GWP-Med, she described the multi-stakeholder programme bringing together the institutional stakeholders in the countries (which include Italy, Sicily, Malta, Greece, and Cyprus) and the Coca-Cola Company / Coca Cola Foundation.

As the Mediterranean Region receives approximately 508 mm (20 inches) of rain per year (compared to over 2,540 mm [100 inches] for the Caribbean region), households have traditionally made use of RWH.

Some of the objectives of the programme included:

- To demonstrate different RWH methods and to promote Non-Conventional Water Resources Management (NCWRs) techniques through pilot applications;
- To train teachers to educate students on NCWR, and increase awareness on sustainable water use; and
- To promote knowledge and sharing of experiences on aspects of integrated approaches to urban water management.

RWH is used for irrigation and flushing. Eighty percent of rainwater is used for washing and 20 percent for bathing. In Greece, the laws require people to have a cistern but this is hardly obeyed, no incentives are given for helping to build cisterns. However, Cyprus provides incentives for grey water use. Outreach includes a very strong education programme, where all schools and all classes are visited, demonstrating water saving tips, and using local knowledge for rainwater management. She concluded by advocating strong education programmes.

Discussion:

- In terms of health issues, the underground tanks are well-sealed and don't pose health problems.

Presentation: The GWP-C Water, Climate and Development Programme (WACDEP) and GWP-C RWH experiences

Presenter: Dr. Natalie Boodram, Global Water Partnership-Caribbean (GWP-C)

Dr. Boodram gave an overview of the educational materials produced by GWP-C. These included the portable RWH model and online toolbox. She indicated that the RWH travelling model was in heavy use in Trinidad and Tobago and has been adapted in Jamaica. She highlighted the project's work in rural areas, especially working with women, and indicated that a list of their publications was available on flash drives, including a sourcebook and information briefs on building climate resilience within the Caribbean water sector. Other programmes highlighted included WACDEP and the knowledge and awareness water and climate knowledge platform.

Presentation: Commercial scale RWH applications: current practices and success stories

Presenter: Andrew Hutchinson, Stantec

The presenter began by giving a background to the water situation from a global perspective indicating that only one percent of global water was useable. He described the geology of Barbados indicating that the island contained coral rock, which acts as a good filter for ground water resources. He noted that Barbados has had ground water protection zones mapped out since 1963; these zones indicate which areas allow development. He described the water infrastructure of Barbados, which includes a desalination plant, and pointed to the initiative by the Planning Authority in 1996 requiring rainwater tanks for each home. The initiative also mandated rainwater tanks for flushing toilets on commercial projects, industry, hotels, and offices; fiscal incentives are given for hardware.

The presenter described five case studies involving large residential, tourism, industrial and commercial developments in which the company had to provide non-potable water storage for various uses, including irrigation of large areas, firefighting, and water reserve, for example at the Mount Gay Distilleries. The company made good use of existing sinkholes, and in one case built a large pond on an existing sinkhole, which was converted to a 0.4 ha (1.5 acre), 25,003.5 m^3 (5.5 million Imp. gal.) lined pond. These are filled using roof and rainwater. He concluded by recommending incentives to be granted on items such as filters for rainwater tanks in order to maximise RWH initiatives.

Discussion:

- A study is needed to determine the impacts on the aquifers from these projects
- There is a need to ensure that storage tanks are suitable for potable water.

Presentation: Application in agriculture: overview of support initiatives and success stories

Presenter: Dr. Lystra Fletcher-Paul, Food and Agriculture Organization of the United Nations (FAO)

The presenter began by pointing out that historically, RWH has been used since ancient times in many countries, particularly in Asia, Africa, and America. She highlighted the work of the FAO in RWH around the world as well as in six Caribbean countries. These included feasibility studies in St Kitts and Nevis by the Brace Centre for Water Resources Management, Mc Gill University (2007); and Antigua and Barbuda, Barbados, Grenada, Jamaica, Dominica and Montserrat by the Caribbean Development Bank (CDB) / FAO / Inter-American Institute for Cooperation on Agriculture (IICA) / Gansu Research Institute for Water Conservancy, China (2008). Dr. Fletcher-Paul then highlighted the FAO pilot project for promoting RWH in south St. Elizabeth in Jamaica. The aim was to improve the management of water and overall productivity of farmers in that part of Jamaica. Among the provisions of the project was the setting up a revolving fund from which farmers are able to buy supplies at 50 percent of the cost, allowing them to pay back to the fund on a gradual basis. It also provided small pumps, concrete water tanks, black tanks, and solar pumps. The project also provided on-farm training and support in agronomy, system operations, and maintenance for over one hundred farmers. Some of the results included an extended growing season, increased crop yields, improved crop quality, and reduced cost of production due to reduced reliance on truck borne water.

Other RWH projects included the construction of storm drains and micro-dams in Antigua and Barbuda. The presenter also referenced tools and guidelines developed by the FAO, among these are GIS Water Deficit Maps and "RWH Methods for Agriculture in the Caribbean Sub-Region". She highlighted several RWH workshops in the region. Challenges cited included the need for a holistic approach, including sensitising farmers to the crops they can grow during the extended season, limited experience of extension services, siltation of micro-dams, and pollution. Lessons learnt included the need for farmers selected for the project to be screened for issues such as their ability to share and land tenure issues, the need to provide links to markets to ensure that farmers can sell their crops, and the need for pest control due to climate change.

Discussion:

- Various plants need different amounts of water.
- RWH projects should be linked with land degradation, climate change, and accessing small grants for RWH.

Private Sector Local Companies (sharing of experiences)

Coconut Bay Resort and Spa Experience, Mr. Gibbs Bakie

The representative of the Resort indicated that the property has a three-day water supply storage capacity of 1,363.8 m^3 (300,000 Imp. gal.) from WASCO. He advanced the view that more RWH tanks would help the resort and water would not have to be closed to the community when it was being pumped to the resort. The RWH system of the hotel has a capacity of 72.7 m^3 (16,000 Imp. gal.), which is only used for the swimming pools. Grey water is processed and used to irrigate the property. He noted the cost associated with the pumps for the RWH systems and supported the use of solar energy or gravity, which would be more cost effective.

Saint Lucia Distillers experience, Mr. Wilson Sifflet

This is a rum distillery situated in the Roseau valley in St Lucia. The distillery is situated close to Roseau River. The company claims that they used to be able to abstract up to 31,822.6 m^3 (7 million Imp. gal.) of water per annum from the river in the past; however, following heavy rains, the turbidity of the river becomes very high and prevents the use of river water at those times. The company thought of using more rainwater storages, but was discouraged by the expense; they considered a pond on land previously used for banana cultivation and are currently using a water supply from the Ministry of Agriculture. They admit that RWH would be easier to use and treat to their standards than current options.

Carasco and Son Ltd., Mr. Ross Gardner

The representative from Carasco and Son Ltd., a private sector company which sells water tanks and other components related to RWH, indicated that although there is no official incentive for RWH in Saint Lucia, the cost is not prohibitive, and after the extreme weather events occurring in Saint Lucia in recent times, there was a massive increase in demand for guttering and water tanks. He proposed that an incentive should be given for cisterns in Saint Lucia. He believed that the main barriers to RWH include the costs of components such as water tanks and guttering for getting the rainwater to the house and this poses a challenge for poor people.

Discussion:

The discussion focussed on various ways in which RWH can be augmented, such as:

- Innovative means of providing guttering should be explored. Reference was made to a project in Morne Du Don (Saint Lucia) where a project was using polyethylene material for building guttering for RWH. The project also provided tanks and pumps. There is a need for creative ways for implementing RWH systems.
- There is a need to look at the Troumasse River as the site for another dam to supplement the John Compton Dam.
- There is need for the use of solar power as well as smaller pumps in RWH facilities. There should be more research on this.
- In Panama, RWH is marketed as an 'elite' activity. There is prestige in 'going green'.
- In Saint Lucia, set-back requirements of the Planning Department call for structures to be 2.44 m (eight feet) from the boundary. This might have hindered the placement of rainwater storage systems in housing areas after Hurricane Tomas.
- It is necessary to take a more holistic view
- There is a need for education in harvesting rainwater for domestic use.
- There is a need to show the urgency for RWH, especially during prolonged drought periods, when there is no water in the taps.

Day 2 Proceedings

Presentations

Presentation: Water Safety and RWH:

- **Challenges with water storage and vector breeding and water safety**
- **Overview of present chikungunya (and dengue) outbreak**

Presenter: Dr. Christopher Cox, Caribbean Public Health Agency (CARPHA)

Dr. Cox identified two main areas of concern with regards to water safety: reducing contamination to the storage that comes from the catchment and reducing contamination that may enter the storage via other means. He noted that the key concern should be making sure that the roof is clean, especially as it relates to vector-borne diseases such as leptospirosis. In this respect, he recommended gutter screening as well as filter design that separates dirty water from clean water. He indicated that the use of filters would depend on the types of pollutants in the area and described methods of minimising contamination in water storage, including chlorine dosing, although typically it is not easy to reach into the tanks in order to pour the chlorine. Suggestions included a remote device which sends a signal to show the level of contamination and the use of UV filters to kill pathogens.

The presenter urged the audience to avoid vector breeding. He noted the following:

- The *Aedes egypti* mosquito is attracted by dark colours;
- The female mosquito needs a blood meal to breed;
- Drums must be totally covered; and
- Chikungunya has heavily impacted the Caribbean region, people frequently suffer from relapses.

The presenter gave a short history of the spread of chikungunya from December 2013 from St. Maarten to the other French islands. It first showed up in the French territories and by April 2014 had spread throughout the Caribbean. He pointed to further information that can be found on the CARPHA website (http://carpha.org).

Presentation: Caribbean Region RWH Programme – Action Plan for a wide up-scaling Implementation of RWH systems

Presenter: Dr. Christopher Cox, Caribbean Public Health Agency (CARPHA)

The presenter referred to the publication: "A Programme for Promoting Rainwater Harvesting in the Caribbean Region", drafted in 2006 which was developed following a consultation in Tortola, British Virgin Islands (BVI). He noted that the publication tried to pull together all aspects of RWH, including the outcome and objective of the programme. He expected this forum to determine whether these should be updated. He referred to the four broad areas to be addressed at the national level and reviewed the actions that were taken under each component.

Component 1: Awareness Raising:

A video, jingles, and other promotional materials were produced, these can be found on the website. He suggested that a survey should be carried out to determine public perception.

Component 2: Capacity building:

- Plumbers were trained in operating and implementing RWH systems, however, the water safety aspect was not necessarily incorporated, so this was identified as a need.
- With regards to trade, one has to prove that RWH is of a quality that meets a certain standard, since commercial ventures require regulations and protocols.
- It was pointed out that in Carriacou, extra water was sold as a commercial activity but there is no regulation.

Component 3 Legislative and Policy Formulation:

- A Tool Kit that countries can use for a public policy framework was developed under this component.
- There is need for a policy on water resources management that should include RWH and should ensure that that RWH issues are addressed in the policy, recognising that the nuts and bolts of the implementation will be a longer process. The law and regulations have to be looked at. It was noted that Saint Lucia could be used as a launch pad as it had made more advances than other countries of the region in this regard.

- Public Awareness should be tailored to lending institutions, which should incorporate requirements for RWH in their lending policy.

Component 4 Infrastructural Development:

Regional level Actions:

- The RWH forum was one such action.
- RWH could be looked at in terms of youth and gender for the development of a model community based pilot, this could be a recommendation from this workshop.
- Regional level actions need to be reviewed and updated so that we can come up with a shared vision.

Discussion:

- The discussion began with a question on the reluctance for RWH to be seen as an acceptable source of water supply, and the need for leadership to ensure this. Some of the reasons given were the fear of revenue loss by the water companies, and the fact that people might not be comfortable with the taste, thus raising both the water treatment and the public health issues.
- The question of who is responsible for the quality of water that is stored in household tanks arose, for example in Trinidad and Tobago there have been queries regarding who owns the water.
- The question of the acceptable level of contaminants in RWH and what level of research has been undertaken in this area was raised. The WHO has published minimum contaminant guides; regulations would depend on the use of the water, such as flushing, drinking or commercial use.
- RWH projects need to factor in the various players such as technical professionals, business people, and politicians, who all have different objectives. The key is to work together for the benefit of the community.

Group Work: Discussion and Validation of the Caribbean Regional RHW Programme

Facilitated jointly by the Caribbean Public Health Agency (CARPHA), the Global Water Partnership-Caribbean (GWP-C) and the United Nations Environment Programme (UNEP)

This section includes the amending and updating of the programme in order to make it relevant to current and emerging issues. This should incorporate regional and international partnerships.

Explanation of the exercise:

This session will look more at the national level actions within the four main components. Participants were requested to bring their experiences and challenges and look at the areas in order to identify whether they are relevant and what new can be added to make it a 'living document'.

Photo 1 Group Work in Progress (Photo by G. Lee Look)

The objective is to capture the main points and recommendations. Each group will look at all four key areas.

Component 1: Awareness Building

Component 2: Capacity Building

Component 3: Legislative and Policy Formulation

Component 4: Infrastructural Development

GROUP WORK RESULTS

COMPONENTS	ACTIONS
Component 1: Awareness building	• Education and awareness of benefits and incentives in schools; • Use of appropriate local language to convey information e.g. Creole; • Use of social media and social marketing (e.g. Edutainment); • Intensive marketing of RWH; • Use information so that persons understand the consequences of inaction; • Use of Knowledge Attitude and Practice (KAP) Study (inclusion of policy makers and senior managers) and use of work from existing processes, identification of gaps: building on these; • Development of region-wide public communication messages to suit various target audiences other than technocrats (e.g. social media, traditional media and others, use of innovative media / tools); • Development of Apps for competitions (e.g. school competitions); • Feedback on websites; • Promoting RWH as a disaster mitigation response mechanism; • Targeting commercial and agricultural sectors - cost saving benefits of RWH; and • Compilation of Best Practices Compendium.
Component 2: Capacity building	• Inclusion of coalition of services; • Participatory workshops (e.g. inclusion of households, farmers, health sector, developers); • Training on RWH for utility operators, tradesmen and others; • Promote RWH technology through innovation, science fairs, promotion of research and development; • Development of training infomercials, hosting of technical seminars; • Development of simple training toolkits and programmes; • Monitoring of RWH systems through involvement of government agencies, setting of specific standards; and • Training of trainers activities.

COMPONENTS	ACTIONS
Component 3: Legislative and Policy Reform	• Review of existing legislation and policy; • Inclusion of traditional knowledge from indigenous communities (e.g. Guyana, Belize, Suriname); • Targeting of cabinet and parliament ministers; • Broad-based water resources management policies adopted at the regional level and country specific legislation; • Utilisation of harmonised approaches for regional policies (E.g. IWRM); • Inclusion of RWH in new development procedures and guidelines; • A strategy that identifies incentives (No Value Added Tax [VAT] on RWH equipment, duty-free materials, property tax reduction), and disincentives for RWH; • Integration of planning framework, demand management, RWH as a component of IWRM Policies; • Building codes need to be updated to include water efficiency; • Demand Management - Water Information Systems to determine demand and allocation – data; • Establishment of baseline for Caribbean RWH mainstreaming; • Establishment of Caribbean RWH Association to monitor RWH practices; • Review of the design of RWH systems and material to be used should be readily available; • Review environmental impact of RWH (e.g. failure of ponds and seepage into waterways); • Certification of RWH equipment; • Establishment of policies for sustainable development - green infrastructure, grey water reuse - make RWH mandatory in commercial and government buildings; and • Green certification for hotels and businesses.
Component 4: Infrastructure and Development	• Provision of soft loans from local lending agencies (e.g. credit unions) - green loans; • Development of funding proposal templates for community led projects (inclusion of agricultural / farming communities); • Development of design guidelines, improvements in technologies and local innovations; • Institutional strengthening of utility companies - updating of databases, determination of capacities of RWH cisterns; • Increasing the number of Hydro-Met stations to forecast weather events - standardisation of equipment, this should be captured in policies and strategies;

COMPONENTS	ACTIONS
	• Standards /inspection - plumbing should meet specifications; • Feasibility studies for retrofitting - short-term retrofitting of existing structures; • Advancement of RWH technologies (R & D) / pilot applications; and • Training and certification at the regional level in RWH.

Discussion:

- The discussion that followed centred on the need to identify critical barriers hindering the implementation of RWH. It was noted that although a great deal was being done at various levels, there was a need for more coordination by a lead regional agency that would take ownership and have the legitimacy to champion this sector. It would also provide a platform for sharing lessons learnt. There was also a call for a coordinated approach among regional agencies.
- Targeting policy leaders, especially the policy makers in the Ministries of Finance, and politicians for the implementation of RWH. These policy makers should be brought into the communities that rely on RWH for everyday use.
- Reaching out to consumer groups, householders, the Ministry of Gender Affairs, Village Councils, and the main users of RWH and consulting with them at the planning stage is important.
- The need for coordination at the local level between the agencies that grant permits for RWH systems in order to close the divide between the various agencies and accelerate the implementation process was discussed.
- Taking a more strategic approach to RWH by producing a work plan that identifies a few key things that can be done and implemented on a step by step basis was highlighted. This should be underpinned by research, making use of new information, and leveraging social media and other telecommunications tools.
- There was need for the incremental implementation of RWH systems, possibly sector by sector, for example beginning with the hotel sector, and focusing on the areas where most returns can be obtained.
- There is a need for sharing of information and best practices on RWH initiatives in various parts of the Caribbean.
- Participants should work in groups by area of interest, for example research, legal framework, and education, among others, from various perspectives as a way forward.

- There is a need to acknowledge that a number of actions on RWH have been undertaken and it was time to determine the best action that could make a significant impact, one such impact could be to compile the outputs from the groups at this forum, get to the key stakeholders, and decide on the time frame for action.
- The Government of Saint Lucia has made a public commitment to 30 percent renewable energy by 2030. It was suggested that the Prime Minister of Saint Lucia could be asked to champion RWH in the region.

The Way Forward

- Formal ratification and endorsement of a lead regional agency for the promotion of the regional RWH strategy;
- Get the programme recognised at regional level, for example COTED - link to post MDGs development agenda; SAMOA Pathway);
- Establishment of partnership arrangements with relevant Caribbean agencies to strengthen outreach and advocacy efforts; assistance with resource mobilisation in the execution of various components of the regional strategy;
- Development of a joint MOU among agencies, including south-south cooperation, to be drafted for circulation;
- Updating of existing websites, for example the GWP-C RWH Toolbox for the capture and dissemination of best practices in RWH;
- Development of social media applications;
- Consolidation of community of practice supported by GEF IW:LEARN; and
- Promotion of RWH through existing regional initiatives such as the FAO school feeding and school gardening programmes.

Day 3: Field Trip

The field trip, which took place on the last day of the conference, was designed to give participants a first-hand view of three sites on which RWH was practiced in Saint Lucia. It also afforded an opportunity for on-sight discussion on the practical issues associated with RWH. The designated sites included:

1) Small-scale installations at Mabouya Valley, Dennery, of select households and a health centre (provided under the GEF-IWCAM Project);
2) A commercial-scale installation at Coconut Bay Resort and Spa, Vieux-Fort; and
3) A commercial-scale installation at Morne Coubaril Estate, Soufriere.

Site 1: Mabouya Valley

Mabouya Valley faces many challenges in water quality and supply. There are several squatter communities here, which do not have adequate water supply in terms of quality and quantity. Sedimentation leads to increased turbidity after rainfall events, making water treatment challenging, causing the closure of the potable supply network. RWH in Morne Panache is a necessary intervention.

Problems observed with RWH installations (in association with the GEF-IWCAM Project):

- Algae developed in the filter;
- Cistern is clogged and the filter is difficult to clean;
- Persons from various communities were trained under the project to check the system on a monthly basis, but this is no longer being done;
- Due to poor water quality, persons in this area use bottled water for drinking; and
- It was suggested that pressure pumps be installed as it was thought to be more energy efficient and easier to maintain.

Issues in the watershed:

- Pig pens are located on river banks and cause pollution. This is a public health threat where persons use the rivers;
- Safe, reliable water supplies are needed;
- There is generally indiscriminate use of the water - no proper water conservation techniques are observed;
- Water borne diseases are common and a problem;
- Water quality tests in the area show high bacterial counts;
- People at higher elevations on the distribution network do not receive a regular water supply from the grid. There is a need for a cost effective system to supply persons at higher elevations;

- Land tenure is a problem and it is difficult to legislate land use. Pesticides from the banana industry caused contamination of water and soil; and

Women in the households should be trained in maintenance of the RWH system.

Site 2: Coconut Bay Resort and Spa

The Coconut Bay Resort and Spa is an all-inclusive 250 room property situated on 34.4 ha (85 acres) in Vieux Fort, Saint Lucia. The resort contains one of the largest waterparks on the island. The resort uses RWH systems with a 16.2 ha (40 acre) reserve on which they intend to expand by another 250 rooms. In addition to the RWH installations, there are also several grey water management installations, including a grey water storage tank and a grey water treatment plant. They have a three-day storage supply from WASCO with a capacity of 1,363.8 m^3 (300,000 Imp. gal.).

Some of their water conservation measures involve the management of the laundry. This is a huge user of water, so the hotel only washes full loads as a water saving measure. They also have a RWH system that stores 72.7 m^3 (16,000 Imp. gal.) only used to supplement the two swimming pools. Grey water is pumped into a tank and treated for irrigation of the grounds.

Sediment from the three sludge ponds is sold to a company. There is a new large greenhouse designed to collect rainwater. The rainwater tank is nicely landscaped within the grounds surrounded by shrubs. It collects water from the four-story hotel building. The water is used for the pool; it is treated with chlorine. For the Lazy river with water slides, WASCO water supply is used but the 45.5 m^3 (10,000 Imp. gal.) tank is used for back-up, especially for back-washing the pool, which uses 45.5 m^3 (10,000 Imp. gal.). The pump room near the pool uses large sand filters. The chlorinator and pump room are housed downstairs.

Site 3: Morne Coubaril Estate

Morne Coubaril Estate is a 101.2 ha (250 acre) property situated in Soufriere, Saint Lucia. The Morne Coubaril estate is one of the few large estates which still remains in the hands of a local family for more than two centuries. In the 1740s, the sugar planters of Martinique suffered a decline in prosperity. Some of them sought to improve their fortunes by selling their sugar estates and establishing coffee plantations, which required less capital expenditure on slaves and on equipment. Several planters moved from Martinique to Saint Lucia, which was still largely unoccupied, so that land could be obtained for little more than the cost of clearing the surrounding forest and bush. The estate is now leased out for a zip line attraction.

This estate uses treated rainwater for almost all of their water needs. Their RWH system uses a 68.2 m^3 (15,000 Imp. gal.) RWH storage plant, which collects water from the roof of the great

house on the estate, which is the family home. The rainwater is stored in tanks housed on the ground floor of the building. The water is tested daily, and treated if needed, by using water purification tablets (1 tablet/22.7 m^3 or 5,000 Imp. gal.). A clear tubing pipe shows the water level in the tanks. The water is being tested by CARPHA on a monthly basis. The tanks are cleaned once a year. The WASCO meter is generally kept shut, except when water is needed from the company – mostly during the dry season. WASCO is contacted before the meter is opened, this is to ensure that the pressure does not break the pipes.

Images from sites

Site 1: Mabouya Valley (Morne Panache)

Rainwater tank outside of the health centre in Mabouya Valley (Photo by G. Leelook)

Residential RWH system in Morne Panache (Photo by G. Leelook)

Site 2: Coconut Bay Resort and Spa

Rainwater tank installation at Coconut Bay (photo by G. Leelook)

Photo of Workshop group at Coconut Bay (Photo by G. Leelook)

Site 3: Morne Coubaril Estate

Main house at Morne Coubaril with RWH system (http://www.stluciaziplining.com/gallery.htm)

ANNEX 1: Questions/comments and sharing of experiences by participants

Participant and participant contact info	RWH: Resources, project, technologies, research, and lessons learnt	Comment	Question
GWP-CAM, Marta Estrada (Guatemala) mc.estradalopez@gmail.com	For Water Pumping Systems - please visit our website to see Fundacion's solar experience for on-grid solar pumping or please send an email to Marta Estrada for more information.		For countries using solar pumps, is the use of solar technology also available for on-grid facilities? In Guatemala, there is a law that allows for the input of energy to the grid, thus reducing the cost of both pumping and the facilities' energy consumption. Are there such laws in the Caribbean? How have consumers / utilities / agencies taken advantage of this - what are some of the experiences regarding this?
GWP-CAM, Marta Estrada (Guatemala)		In reference to Everson Peters' comment that we do not pay the true cost of water - in places like Guatemala this is also the case where trying to fairly price water transcends the policy issue. It then becomes a delicate social issue which involves even indigenous councils; policy makers need to take these factors into consideration.	Regarding water quality for the systems presented on Day 1: Is salinity an issue and does moss and algal growth affect the filters?
GWP-CAM, Marta Estrada (Guatemala)	Lessons learnt: In regions such as the isthmus of Central America, water		

Participant and participant contact info	RWH: Resources, project, technologies, research, and lessons learnt	Comment	Question
	scarcity although present is not yet an issue - there is high availability of water but the issue is lack of distribution and access to safe supplies.		
GWP-CAM, Marta Estrada (Guatemala)			Has research and development into the use of cloud forests for capturing fog been done in the region - is it something that has been explored? Is it even feasible in the Caribbean?
GWP-CAM, Marta Estrada (Guatemala)		It is important in countries as diverse as Guatemala to promote “use” but with “inclusion”. This means respecting territories and indigenous people’s rights and idiosyncrasies regarding natural resources management (land and water)	
GWP-CAM, Marta Estrada (Guatemala)		Appropriation of technologies is key to success - using local materials, promoting productive use (to generate income) and ensuring adequate use and maintenance are also key to the sustainability of these systems.	
GWP-CAM, Marta Estrada (Guatemala)		Other systems used in Guatemala for the direct harvesting and use of rainwater includes the construction of ditches along crop lines in such a way that it captures and distributes the water to	

Participant and participant contact info	RWH: Resources, project, technologies, research, and lessons learnt	Comment	Question
		assure the irrigation of crops as well as the humidity conservation of the soil.	
Water Resource Authority (WRA), Anika Sutherland (Jamaica) asutherland@wra.gov.jm (876) 420-4209/ (876) 402-4133	The WRA in Jamaica has worked on rainfall reliability and design for RWH Infrastructure. It started as a project funded by the FAO to look at agriculture, but the domestic supply was also investigated. Contact Anika Sutherland for further documentation on this project.		
WRA, Anika Sutherland		Regarding the comment of "who owns water" - this is a tricky situation in Jamaica. As regulators of abstraction from sources, the WRA has issued a license to Rose Hall Development Company, which harvests rainwater from gullies. Could it be that the WRA is overstepping boundaries by licensing this commercial entity but not other local rainwater harvesters? There is also a school of thought that RWH could impact the local groundwater recharge.	
WRA Anika Sutherland		Set a measurable target within a certain timeframe to achieve regional RWH, for example increase RWH system installation by 30 percent in three years, or	

Participant and participant contact info	RWH: Resources, project, technologies, research, and lessons learnt	Comment	Question
		introduce the public to the improvements and new developments in global RWH.	
WRA Anika Sutherland	The use of school competitions to promote RWH: In Jamaica, students were encouraged to participate in RWH competitions and the prize for the winner was the installation of a RWH system at the school. Installation services, tanks, and other equipment were donated to the schools and this was capitalised as community outreach / assistance. Persons were able to learn from the experiences - it is noteworthy that politicians like these community demonstrations projects and the media attention associated with it.		
WRA Anika Sutherland		In terms of legislation and policy formulation- in Jamaica, for low national housing loans are given for the installation of solar panels. Maybe this might be something to consider for RWH but what will be needed are separate policies to guide the process GWP-CAM Marta Estrada (Guatemala)	
Anonymous		Formulation of a Caribbean RWH Association to regulate and monitor systems.	

Participant and participant contact info	RWH: Resources, project, technologies, research, and lessons learnt	Comment	Question
CERMES, UWI, Dr. Adrian Cashman adrian.cashman@cavehill.uwi.edu	CERMES is currently supervising a RWH perceptions research project in Barbados, in addition to this, a few RWH studies have been done in Barbados over the years - CERMES would be willing to share the reports from these studies.		
Anonymous		RWH may be most effective if it is targeted at areas where it could most effectively reduce the government's burden of subsidising water to the populace, for example in public buildings, and low income housing communities, where government finance would be required to extend network coverage.	
Anonymous		RWH for commercial purposes should be implemented in a way that it does not cripple the water service provider's revenue generation abilities. This is in light of cross-subsidies built into tariff designs where commercial rates are used to subsidise costs to residential consumers.	
Anonymous		RWH should be integrated as part of the overall IWRM and mapping, similar to that which was done for the energy sector in Saint Lucia. In that way, specific sectors and	

Participant and participant contact info	RWH: Resources, project, technologies, research, and lessons learnt	Comment	Question
		communities can be targeted based on water supply and water demand challenges of these groups. These should be the ones given incentives.	
Coconut Bay Resort and Spa gbakie@cbayresort.com	Coconut Bay's RWH systems utilise Rhino Wholehouse Water Filters and Caribbean Clear products (silver and copper electrolysis).		
Isabelle Vander Beck isabellevanderbeck10@gmail.com	Katadyn (Swiss technology - www.katadyn.com) is a great water filter which can be put onto the main; they are very robust and external - the investment is high but worth it.		
Andrew Hutchinson Andrew.hutchinson@stantec.com	Water filters (0.4 microns) by General Ecology Inc. (www.generalecology.com) are US EPA certified and remove viruses, bacteria, protozoa, organic chemicals, inorganic chemicals, and parasitic cysts.		
Anonymous		There is urgent need to verify the quality of RWH systems in both urban and rural areas to substantiate the quality and properties - this effort also has to be supported by data.	
Terrence Smith tsmith@tpsmithengineering.com		Suggestion of how to utilise a water pumping system using a solar powered pump: A smaller tank will be connected via guttering to the roof to	

Participant and participant contact info	RWH: Resources, project, technologies, research, and lessons learnt	Comment	Question
		collect the rainwater and feed the solar powered pump - low flow, high head (the pump would be connected to the solar panels so that the panels power the pump). The pump should then be connected to a larger tank so that rainwater flows into the smaller tank and is pumped to the larger tank. The larger tank will then be positioned in such a way that it can supply the household through gravity flow. The recommendation here is that more research into affordable solar pumps, especially at the residential level, is conducted.	

ANNEX 2 List of Participants

Rainwater Harvesting (RWH) Knowledge Network Forum		
21-23 October, 2014		
Bay Gardens Inn. Saint Lucia		
NAMES OF PARTICIPANTS	**ORGANISATION (PROJECT AFFILIATION)**	**Country**
Keith Nichols	CCCCC	Belize
Davvia DeMerieux	CCST	Trinidad and Tobago
Terrence Smith	CWWA	Barbados
Ignatius Jean	CAWASA	Saint Lucia
Deborah Bushell	CARPHA	Saint Lucia
Christopher Cox	CARPHA	Saint Lucia
Lesmond Magloire	CARPHA	Saint Lucia
Shermaine Clauzel	CARPHA	Saint Lucia
Anika Sutherland	WRA	Jamaica
Gibbs Bakie	Coconut Bay Resort and Spa	Saint Lucia
Egbert Louis	Engineering consultant	Saint Lucia
Lester Arnold	Engineering consultant	Saint Lucia
Lystra Fletcher Paul	FAO	Barbados
Fitzgerald John	Fond d'Or Foundation	Saint Lucia
Horst Vogel	CATS / GIZ	Saint Lucia
Eva Näher	CATS / GIZ	Saint Lucia
Sharika Mandeville	Government of Saint Vincent	Saint Vincent and the Grenadines
Gadeshwar Ishwarden	Ministry of Water and Housing	Guyana
Natalie Boodram	GWP-C	Trinidad and Tobago
Ermath Harrington	GWP-C	Trinidad and Tobago
Fredricka Deare	GWP-C	Trinidad and Tobago
Paul Hinds	GWP-C	Trinidad and Tobago
Marta Estrada	GWP-CAM	Guatemala
Rhona Diaz	GWP South America	Panama
Candi Hosein	GWP-C	Trinidad and Tobago
Gabrielle Lee-Look	GWP-C	Trinidad and Tobago

Ms. Konstania Toli	GWP-Med	Greece
David Lumkong	Mount Coubaril Estate	Saint Lucia
Sean Deolat	National Institute of Higher Education, Research, Science and Technology (NIHERST)	Trinidad and Tobago
Skeeter Carasco	National Water and Sewerage Commission (NWSC)	Saint Lucia
Kelly Joseph	NWSC	Saint Lucia
Norma Cherry-Fevrier	OECS	Saint Lucia
Tecla Fontenard	OECS	Saint Lucia
Trevalyn Clovis	Trust for the Management of Rivers (TMR)	Saint Lucia
Raphael Eudovique	Consultant	Saint Lucia
Naula Williams	Rapporteur	Saint Lucia
Wilson Sifflet	St Lucia Distillers	Saint Lucia
Nicholas Barnard	St Lucia Linen	Saint Lucia
Susanna Scott	Ministry of Sustainable Development	Saint Lucia
Sarah and Chris Watts	Ti kaye Village	Saint Lucia
Christopher Corbin	UNEP	Jamaica
Isabelle Vanderbeck	UNEP	United States of America
Henry Smith	University of the Virgin Islands (UVI)	USVI
Adrian Cashman	UWI	Barbados
Everson Peters	UWI	Trinidad and Tobago
Bernard Fanis	Videographer	Saint Lucia
Vincent Hippolyte	WASCO	Saint Lucia
Hastin Barnes	Antigua Public Utilities Agency (APUA)	Antigua and Barbuda
Andrew Hutchinson	STANTEC	Barbados
Steve Hudson	WRA	Jamaica

ANNEX 3: Rainwater harvesting (RWH) Knowledge Network Forum

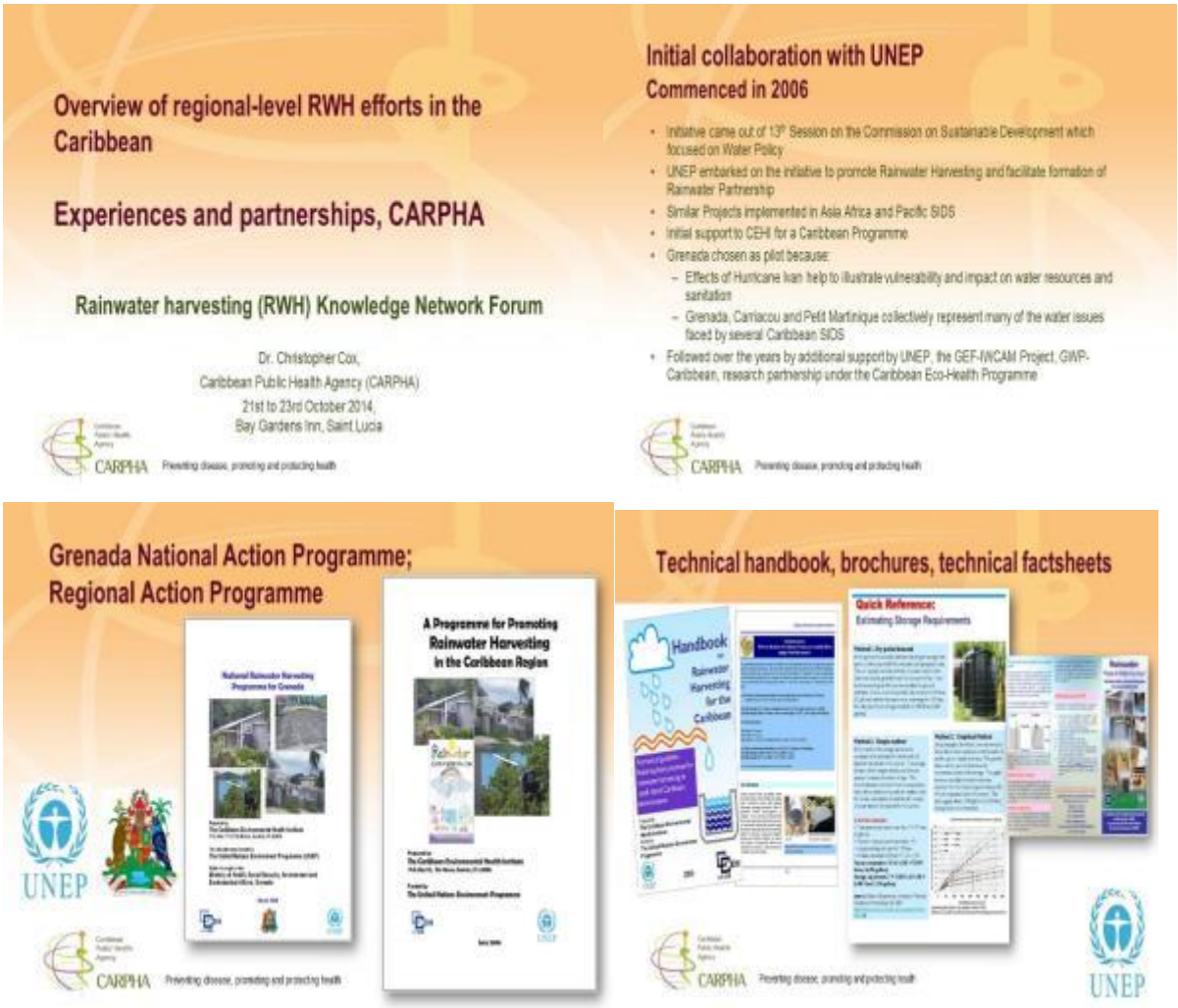
AGENDA

Time	Session detail	Lead presenter/facilitator
Day 1	**Knowledge and practices**	
9:00 – 9:20	Brief opening remarks by partners • Caribbean Public Health Agency • GEF Amazon Project • Global Water Partnership – Caribbean • United Nations Environment Programme; GEF-IWLEARN • German International Cooperation	Dr. Christopher Cox Dr. Nobert Fenzl Paul Hinds Christopher Corbin Dr. Horst Vogel
9:20 – 9:40	Opening remarks	Permanent Secretary, Ministry of Sustainable Development
9:40 – 9:50	Participant introductions	
9:50 – 10:15	Overview of regional-level RWH efforts in the Caribbean, CARPHA and OECS Secretariat • *A summary of past and current initiatives*	Dr. Christopher Cox, CARPHA, Norma Cherry-Fevrier, OECS Secretariat
10:15 – 10:30	BREAK	
10:30 – 11:00	The climate dimension and water resources • *The climate outlook for the Caribbean and strategic directions for enhancing water security* • *How rainwater harvesting may contribute; policy and fiscal challenges*	Dr. Adrian Cashman
11:00 – 12:40	Regional experiences with RWH • *Overview of driving issues for investment, achievements and challenges*	
	The Grenadines	Dr. Everson Peters UWI
	The Virgin Islands	Dr. Henry Smith, UVI
	The Amazon Basin	Dr. Nobert Fenzl *(via skype)*
	Central America	Rhona Diaz; Marta Estrada
	The Mediterranean	Konstania Toli – GWP-M

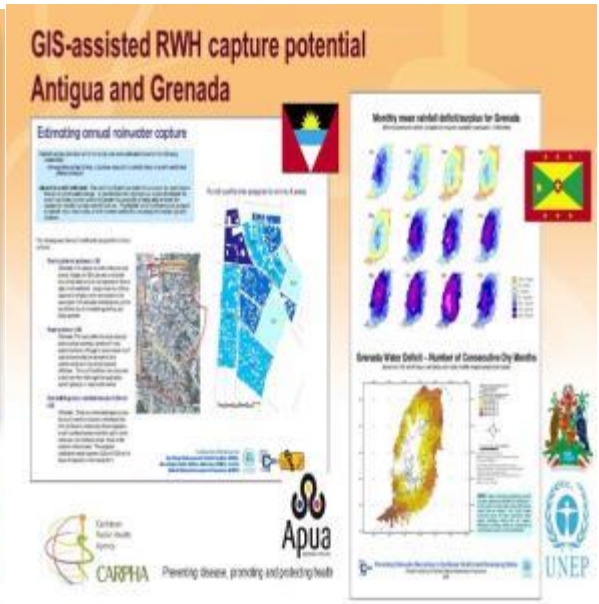
Time	Session detail	Lead presenter/facilitator
12:40 – 1:00	The GWP-C Water and Climate Development Programme (WACDEP) and GWP-C RWH experiences	Dr. Natalie Boodram, GWP-C
1:00 – 2:00	LUNCH	
2:00 – 2:30	Commercial-scale RWH applications • *Current practices and success stories*	Andrew Hutchinson
2:30 – 3:00	Applications in agriculture • *Overview of support initiatives and success stories*	Dr. Lystra Fletcher-Paul, FAO
3:00 – 3:15	BREAK	
3:15 – 4:15	Experiences from the private sector	Local companies - TBD
4:15 – 4:30	Wrap-up	
Day 2	**Strategic directions**	
9:00 – 9:30	Water safety and RWH • *Overview of present chikungunya outbreak (and dengue)* • *Challenges with water storage and vector breeding and water safety*	TBD, CARPHA
9:30 – 10:00	Caribbean Regional RWH Programme - Action plan for a wide up-scaling implantation of RWH systems • *Presentation on the programme elements*	Dr. Christopher Cox
10:00 – 10:15	BREAK	
10:15 – 12:30	Discussion and validation of the Caribbean Regional RWH Programme • *Amending and updating the programme to make relevant to the current and emerging issues. This should incorporate regional and international partnerships.* (This will take the form of group review of the action plan followed by interactive plenary discussion)	Facilitated by jointly by CARPHA, GWP-C and UNEP
12:30 – 1:30	LUNCH	

Time	Session detail	Lead presenter/facilitator
1:30 – 3:00	Discussion on formulation of the RWH Partnership (Cooperation Network) • *Further advancement of the RWH GWP-C website/portal* • *Development of social media applications* • *Consolidation of community of practice supported by GEF IW-LEARN*	Facilitated by CARPHA and GWP-C
3:00 – 3:15	Wrap-up	
Day 3	**Field trip**	
9:00	Depart hotel	
10:00 – 11:00	Small-scale RWH installations, Mabouya Valley, Dennery • Select schools, health centre, households	Ananias Vernieul
11:30 – 12:30	Commercial-scale installation, Coconut Bay Resort and Spa, Vieux-Fort	Gibbs Bakie
1:00 – 3:00	Commercial-scale installation, Morne Coubaril Estate, Soufriere (lunch at location)	David LumKong
3:00 – 3:20	Wrap-up	
3:30	Return to Castries via West Coast	

ANNEX 4 Presentations from the Workshop




Posters
Rainwater
"Harvesting the Heavens"
Rainwater
Rainwater
Catch it While You Can!
CARPHA
Preventing disease, promoting and protecting health
UNEP


GIS-assisted RWH capture potential
Antigua and Grenada
Estimating annual rainwater capture
Apua
CARPHA
Preventing disease, promoting and protecting health
UNEP

Installations – Mabouya Valley

GEF- Integrating watershed and Coastal Areas Management project

Target - extreme water-stressed communities in project watershed **installations on schools, health clinic, lower income households**

CARPHA Preventing disease, promoting and protecting health

Communal RWH system rehabilitation Union Island and Carriacou

Donaldson Catchment, **Union Island**
Hospital Hill, L'Estere, Beausejour, **Carriacou**

CARPHA Preventing disease, promoting and protecting health

NAWASA

Demonstration Antigua and Barbuda

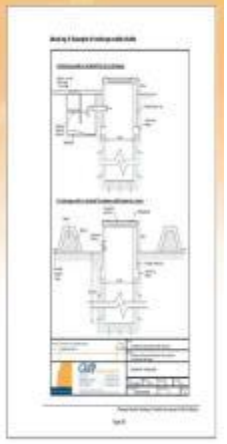
UNEP

Apua

CARPHA Preventing disease, promoting and protecting health

Managed Aquifer Recharge (MAR)

- Aim: to produce a useful and practical guideline for the capture and management of surface water for aquifer recharge in the Caribbean Region, with a particular case study focus on Antigua and Barbuda.



Apua UNEP

CARPHA Preventing disease, promoting and protecting health

Rainwater Harvesting Mobile Display

- Tool for dynamic learning
- Provide a real example of how an actual rainwater harvesting system should operate (water pumped through system)
- Employed off-the-shelf materials for main components (guttering, first flush diverter, filters)
- Interpretive panels for additional information

Global Water Partnership Caribbean

CARPHA Preventing disease, promoting and protecting health

Web-based Toolbox – Clearinghouse on RWH in the Caribbean

- Collection of knowledge based on CARPHA's (CEHI) work
- Intended to be a resource pool for information on RWH
- Encourage users to consult and contribute knowledge
- Part of GWP's global resource suite
- http://www.cehi.org.lc/Rain/Rainwater%20Harvesting%20Toolbox/index2.htm

Global Water Partnership Caribbean

CARPHA Preventing disease, promoting and protecting health

Caribbean Eco-Health Programme

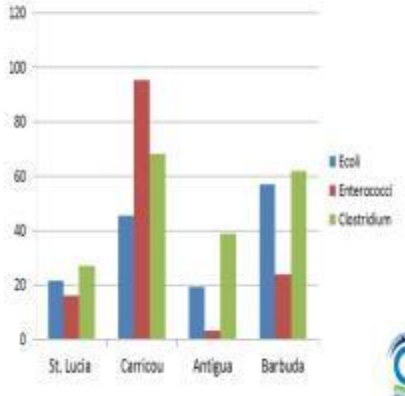
Knowledge, Attitude, Practice and Behavior (KAPB) Study on Rainwater Harvesting and Investigation of microbial water quality of stored rainwater

- Antigua & Barbuda, Carriacou and Saint Lucia
  - Selected to represent range of RWH use
- Carriacou (50 households, 10 organizations)
- Antigua (178 households, 10 organizations)
- Barbuda (44 households)
- St. Lucia (249 households and 11 organisations)
  - Pre and Post Hurricane Tomas
- 115 water samples taken and tested

CARPHA Preventing disease, promoting and protecting health

Caribbean Eco-Health Programme

% of water samples from each country that WHO water quality drinking guidelines



Barriers to RWH practices identified from all countries

- Too much effort
- Lack/cost of storage devices
- Problems/cost of guttering
- Worried about pollution/mosquito breeding

CARPHA Preventing disease, promoting and protecting health

New initiatives

Caribbean Strategic Programme for Climate Resilience (SPCR) - Mainstreaming Rainwater Harvesting (RWH) in the Caribbean

- Target countries: Jamaica, Haiti, Dominica, Saint Lucia, St Vincent & the Grenadines, Grenada
- Key outputs:
  - Service providers trained in design, installation and maintenance of RWH systems
  - Technical fact sheets (electronic copies only) and Second edition of RWH Handbook produced.
  - Regional model of RWH code of practice developed for adaptation at the national level
  - Policy and incentive regimes informed by appropriate economic analyses developed to facilitate investment in RWH in key economic sectors
  - Water vulnerability map developed for each target PPCR country
  - Best practices in RWH implemented in suitable public buildings in selected communities

CARPHA Preventing disease, promoting and protecting health

3.2: Overview of Rain Water Harvesting Efforts in the OECS. Norma Fevrier (OECS)

OVERVIEW OF RAINWATER HARVESTING EFFORTS IN THE OECS REGION

WHY HARVEST RAINWATER?

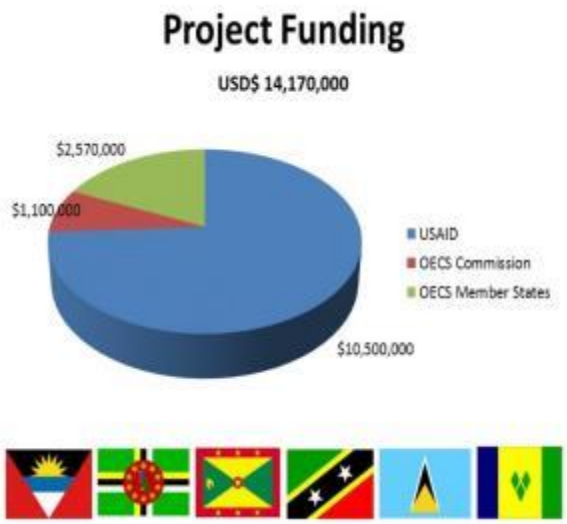
OUTLINE:

- Overview of the RRACC Project
- Project Components
- **Component 2 – Water availability identified as an issue in the face of climate change**
  - Rainwater Harvesting Initiatives in 4 OECS Member States
  - Rainwater Harvesting Technologies
- 2014 – 2015 Workplan

OVERVIEW OF THE RRACC PROJECT

General Objective:

To seek to enhance the overall, long-term capacity of the OECS region to respond to climate change, while strengthening the near-term resilience of Member States to climate change impacts, through concrete on-the-ground actions.


Project Funding
USD$ 14,170,000
$2,570,000
$1,100,000
$10,500,000
USAID
OECS Commission
OECS Member States


PROJECT COMPONENTS
1. Improving the Enabling Environment
2. Sectoral Interventions
3. Information Strengthening
4. Public Awareness & Capacity Building
5. Project Management
OECS RRACC Project

COMPONENT 2 – SECTORAL INTERVENTIONS (FRESHWATER)

Country Consultations

Water Availability | Critical Issue

Build Resilience & Adapt to Climate Change

Rainwater Harvesting | OECS Member States

RAINWATER HARVESTING INITIATIVES

EC$976,622 70,000 gallons	EC$18,700.16 1,000 gallons	+ building costs 25,000 gallons	EC$872,820.90 Reservoir – 287,000 Tanks – 40,000
Saint Vincent and the Grenadines (6 Sites)	Grenada	Dominica	Barbuda

EC$1,868,143.06 to Capture and Store 423,000 Gallons of Rainwater

SAINT VINCENT AND THE GRENADINES (6 SITES)

Sandy Bay Government School, Georgetown Community Centre, Park Hill Primary School, Langley Park Government School, Richland Park Government School and Liberty Lodge Boys Training Centre

GRENADA

Improving the water supply for the propagation of seedlings at the Grand Etang Forestry Nursery, Grenada

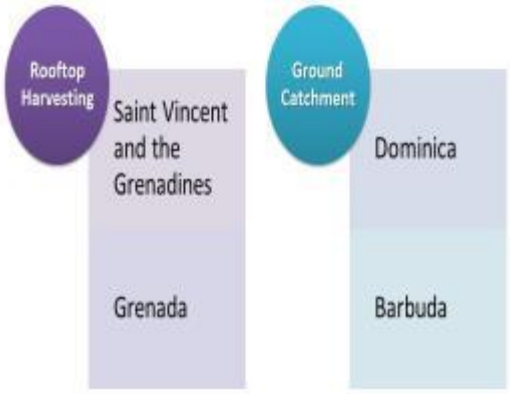
DOMINICA (Londonderry)

Due to drought and increasing dry spells, rainwater harvesting and storage systems for livestock pens will be constructed to enhance the model farm's ability to demonstrate sustainable agricultural practices

BARBUDA (Highlands Area)

Due to drought and the unavailability of water, a water catchment and storage system is being constructed to support farming

Rainwater Harvesting Technologies



MOVING FORWARD

The OECS RRACC Project
Tel: 1-(758)-455-6365/455-6351
Email: tfontenard@oecs.org, rlay@oecs.org, nfevrier@oecs.org or dfrancois@oecs.org
Website: www.oecs.org

Climate Dimensions and Water Resources

Climate Outlook, Water Security and Rainwater Harvesting

Overview

- Climate outlook
- Water security
- Rainwater harvesting

Climate outlook – What do we expect

Temperatures (2075–2099)

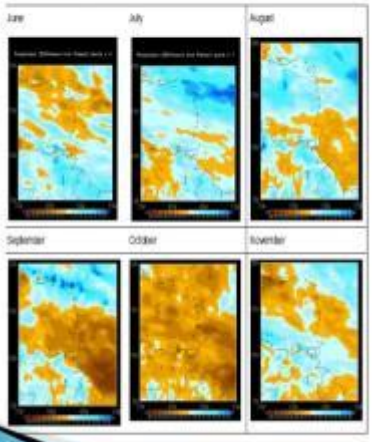
- A1B emissions scenario
  - 2.5–3 °C rise in temperatures for the northern and southern Caribbean
  - 2–2.5 °C for the eastern Caribbean for the.
  - Increase in the number of days and nights where temperatures exceed 35 °C during the day and 25 °C at night
  - Greater warming in the summer months than in the cooler, drier early months of the year
- Sea level rise
  - Between 5 – 10 mm per year

Climate outlook – What do we expect

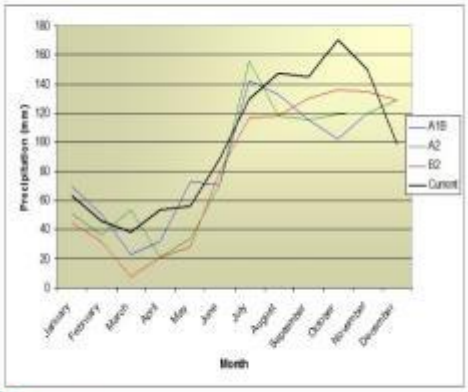
Rainfall (2075–2099)

- Decrease in annual precipitation of 10%–30% by 2080
  - Wet season a 30% decrease in monthly precipitation for the Northern and 20% for the Eastern Caribbean is projected
  - Belize and Guyana increases of between 20% and 30% during the wet season are projected
  - Analysis of the mean daily precipitation indicates:
    - 10%-15% decrease in higher intensity rainfall for the northern Caribbean
    - Increase in intensity of at least 15% for the southern Caribbean
    - No change for the Eastern Caribbean
- General drying trend, by 2050:
  - Reduced length of rainy season 7–8%
  - Increased length of dry season 6–8%

Changes in Monthly Rainfall Patterns, A1B Scenario
1990's-2070's



Barbados' Climate Change



Impact of reduced precipitation on RWH in the Grenadines (Peters, 2010)

Current operational Parameters	Change in rainfall	Required change in roof area	Required change in tank size	Required change in per capita consumption
Roof area 112m²	- 5%	+6.5%	+ 82%	- 5.5%
Tank size 100 m³	- 10%	+8.5%	+ 140%	- 12%
Per capita use 78 l/p/d	- 15%	+ 19%	Not possible	- 15%
Occupancy 4.9	- 20%	+ 27%	Not possible	- 19%

So, some things to think about:

1. What about climate variability?
2. What does this mean for water resources?
3. What does it mean for water supplies?

Some uncomfortable facts

- Many Caribbean countries experience seasonal shortages
- Demand exceeds supply during parts of the year
  - Barbados is 'closed'
  - St Lucia 35% deficit
  - Jamaica in deficit 2015
  - Trinidad in deficit since 2000
  - Un-accounted for water often >40%
- Add periodic drought events
- Demand often peaks in dry season
- Populations becoming more urbanised

Water security

- So what might this mean for the state of water resources in the Caribbean?

What is water security?

You tell me.....

Water Security

Global Water Partnership has defined a water secure world as one that:

"...integrates a concern for the intrinsic value of water together with its full range of uses for human survival and well-being.....harnesses water's productive power and minimises its destructive force.....where every person has enough safe, affordable water to lead a clean, healthy and productive life." and "It is a world where communities are protected from floods, droughts, landslides, erosion and water-borne diseases."

OR

Water security is defined as the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability. (UN-Water, 2013)

Elements of Water Security

- Adequacy
  - Conditions governing water resource availability in time and space that satisfies often competing demands and the nature of the demands that drive exploitation
- Accessibility
  - Ensuring that water is available when and where it is needed in such a way that is not an undue burden
- Assurance
  - Ability to secure safe and sufficient resources to cope with potential system shocks such as extreme events, security threats and contaminated resources.
- Affordability
  - For providers and users of water services; how water management and services are to be paid for

Rainwater Harvesting

» The Challenges

Examples

Challenges: SLEEP T

- Social
- Legal
- Economic
- Environmental
- Political
- Technical

Addressing the challenges

- Do we think that RWH is a viable Adaptation measure in the face of climate change
  - Context e.g. other available options
- Should we encourage RWH
  - What for ?
  - How ?

3.4: Regional experiences with RWH in the Grenadines. Dr. Everson Peters (UWI)

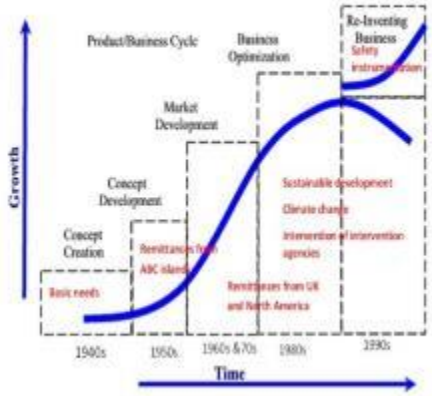
Some experiences

What are the driving issues for investments achievements and challenges?

Relevant questions

- What are the current investments in the region?
- What are the ongoing projects?
  - number of persons to benefit-
  - no of households
  - costs per unit
- Is there need to relook the model for promoting RWH?

RWH as a business product



RWH as a business product

- There are different product parts in RWH which are released and designed to improve the efficiency in service of a product.

What are these products?

Demand side

- reduce use (conservation methods, low volume toilets and showers, drip irrigation for landscaping
- using small scale water reuse
- continuous monitoring of water availability)

Demand side

RWH per capita consumption

location	L/p/d	Position on business cycle
Plum Mitan	95 to 110	mature
Toco/Matelot	269	Early
Blanchisseuse (domestic)	231	Mature
Blanchisseuse (green house farming)	680	Mature
Carriacou (domestic)	127	Mature
Carriacou (small hospital)	1645	mature

RWH as a business product

Supply side

- maintenance to reduce losses-leakage, cost effective repair
- metering helps detect leakage, (unusual consumption is readily identified) eg the Princess Royal hospital found that significant water loss
- maximising roof area- typical increasing roof area represents only a fraction installation cost

RWH as a business product

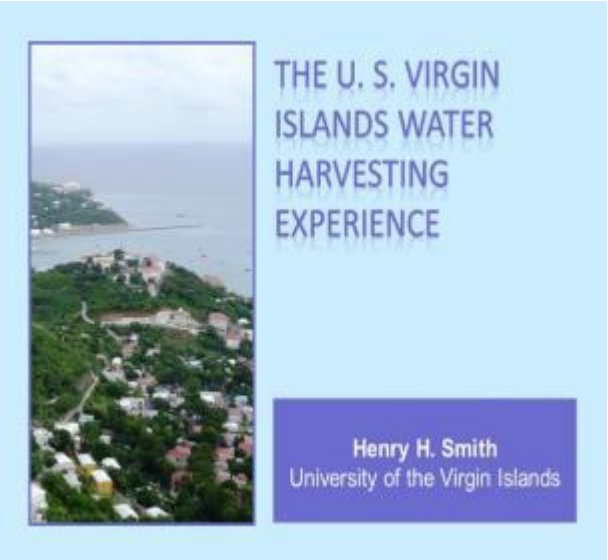
Quality issues

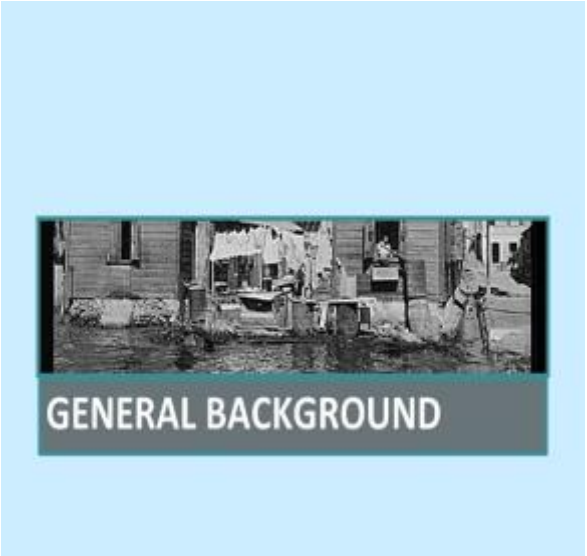
- Purification -Filtering
- Solar operated UV systems
- Safety of water transport in the dry season (unregulated service providers)

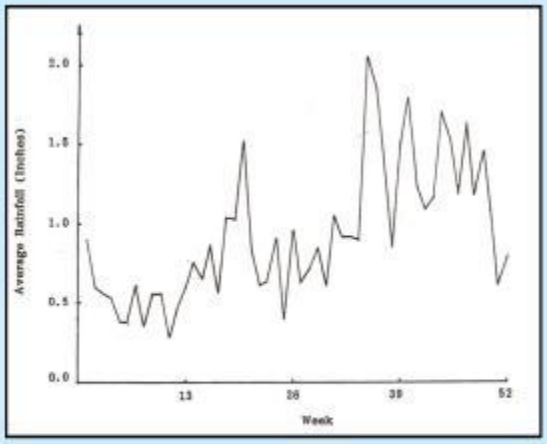
Key lessons for investment

- Need drives investments
- Unit expansion
- Appropriate (meaningful) incentives

3.5: Regional Experiences with RWH the US Virgin Islands. Dr. Henry H. Smith (University of Virgin Islands)







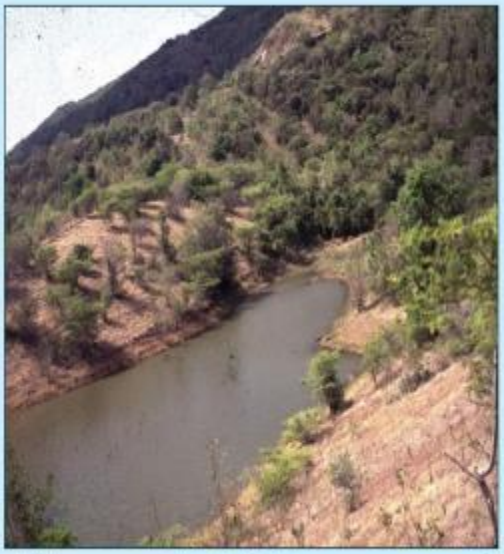
Weekly Rainfall Averages at Sprat Hole

Henry H. Smith RWH Knowledge Network Forum Slide 3

Monthly Rainfall Averages in St. Croix, Cayman Islands and Belau

Henry H. Smith RWH Knowledge Network Forum Slide 4

SURFACE WATER



Henry H. Smith RWH Knowledge Network Forum Slide 6

GROUND WATER

Henry H. Smith RWH Knowledge Network Forum Slide 8

SEA WATER

DESALINATION

DESALINATION

Henry H. Smith RWH Knowledge Network Forum Slide 13

Henry H. Smith RWH Knowledge Network Forum Slide 14

RAINWATER HARVESTING

Henry H. Smith RWH Knowledge Network Forum Slide 16

Henry H. Smith RWH Knowledge Network Forum Slide 17

Henry H. Smith RWH Knowledge Network Forum Slide 18

USVI Cistern Law

TITLE TWENTY-NINE Public Planning and Development
Chapter 5. Building Code
Subchapter VIII. Water Supply

29 V.I.C. § 308 (2013)

§ 308. Water supply, cisterns, gutters, downspouts, wells

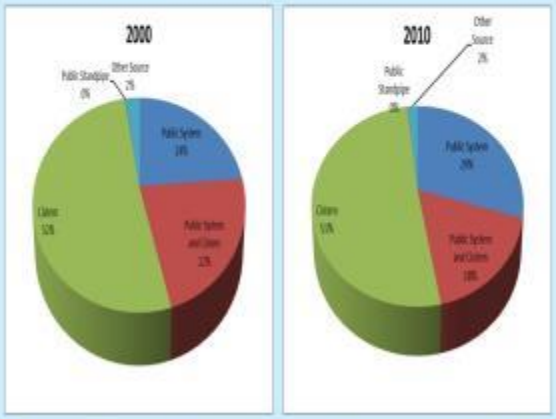
(a) General. After May 1, 1964, no building; except commercial developments dwellings and single unit apartments with connected access to the potable water system, shall be constructed, enlarged, or moved unless the owner thereof shall make provision for a self-sustaining water supply system. This system shall consist of a well or rainwater collection area and **cistern.**

(b) Cistern capacity. (1) Cisterns for dwellings, apartments and hotels shall have a minimum usable capacity of 10 gallons for each square foot of roof area for buildings of one story and 15 gallons for each square foot of roof area for buildings of two or more stories. If a dwelling shall have access to the potable water system and is verified by appropriate WAPA officials and service is installed, no **cistern** will be required.

(2) All other buildings shall have **cisterns** with a minimum usable capacity of 4 1/2 gallons for each square foot of roof area except that churches and warehouses shall not be required to conform to this standard. If at any time buildings formerly used for churches and warehouses are converted to other uses compliance shall be required.

(3) Where a building has combined occupancy, such as apartment and store, required **cistern** capacity shall be 10 gallons for each square foot of roof area.

Domestic Water Sources



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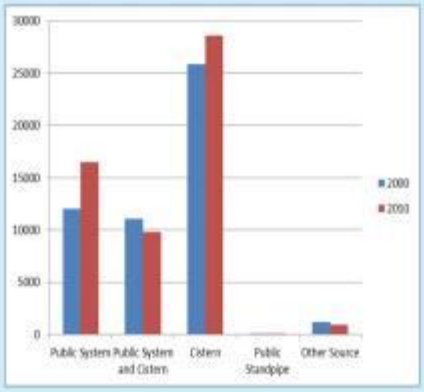
Water Sources for Domestic Use



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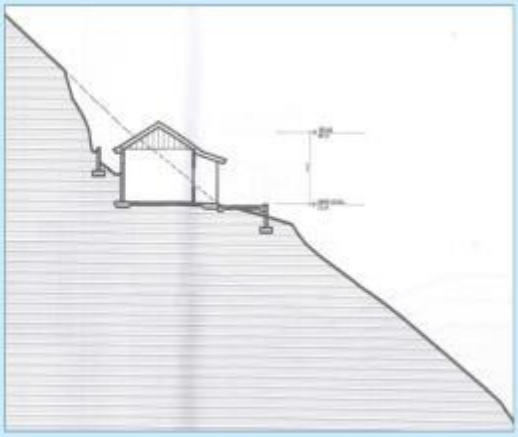
Henry H. Smith RWH Knowledge Network Forum Slide 25



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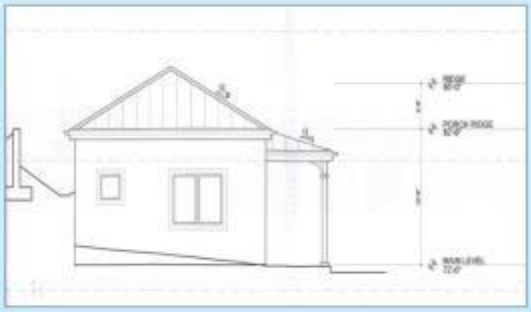

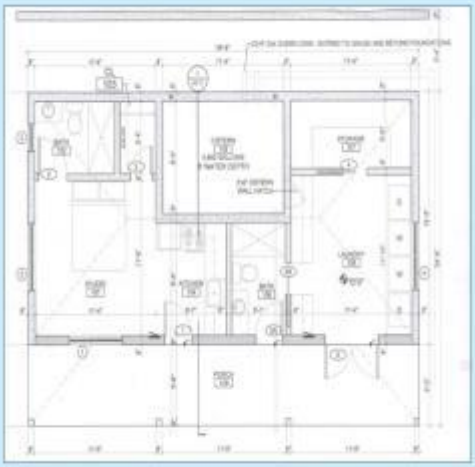

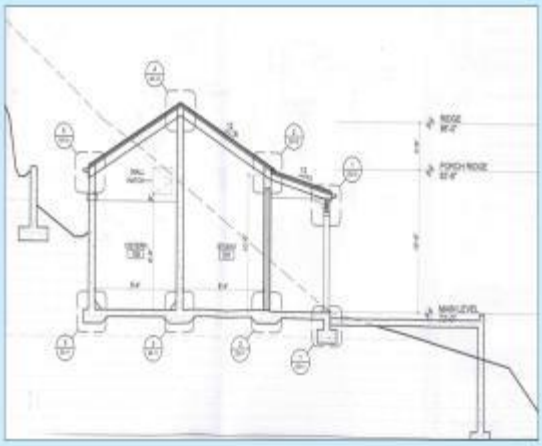

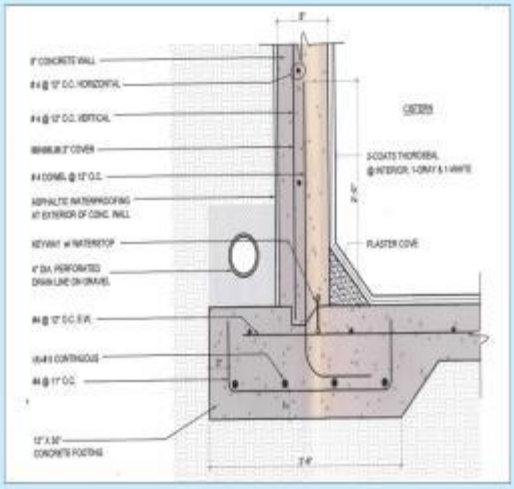

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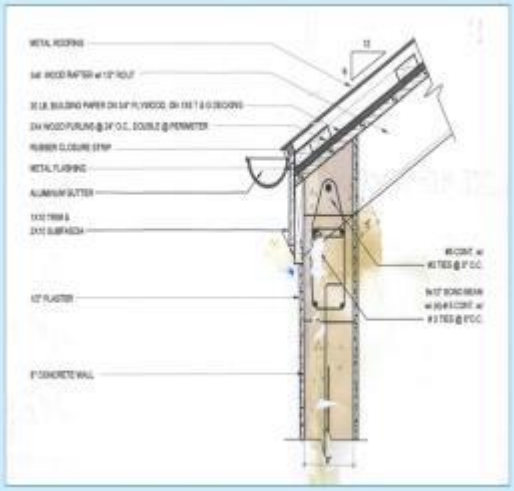

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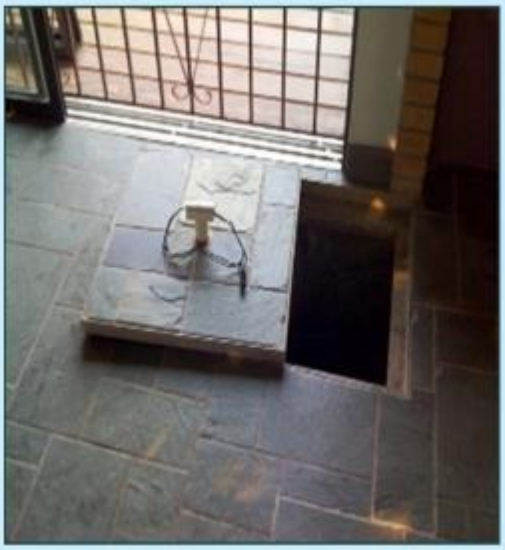

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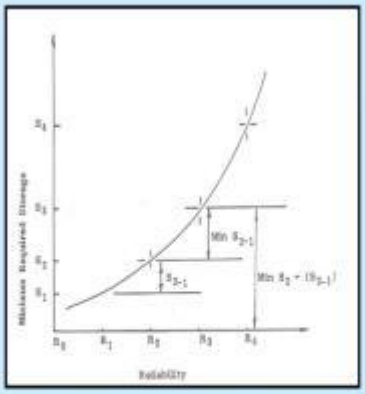


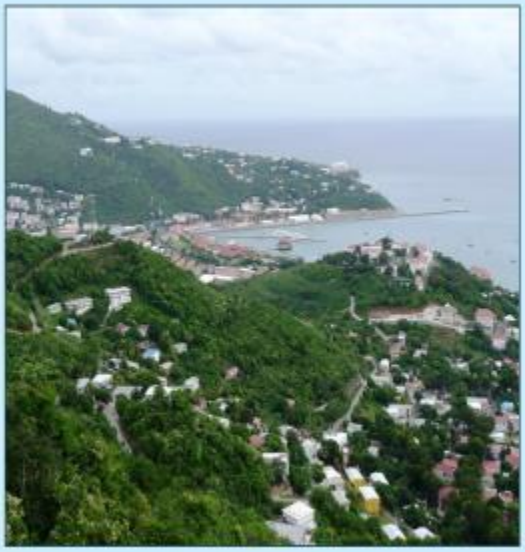
Computation of Minimum Feasible Required Storage

Annual Mean	52.42	47.89	148.17
Monthly Mean	4.37	3.99	12.35
Standard Deviation	2.58	1.56	2.67
Coefficient of Variation	0.67	0.40	0.22

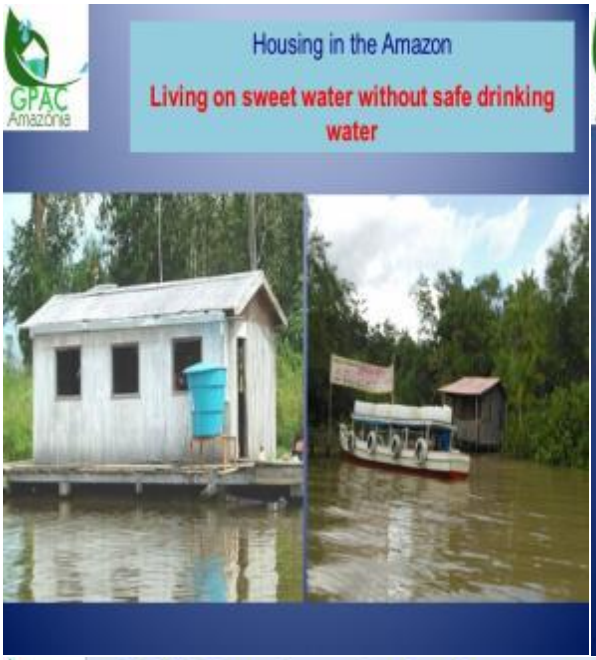
Monthly Rainfall in Cayman Islands, St. Croix and Belau

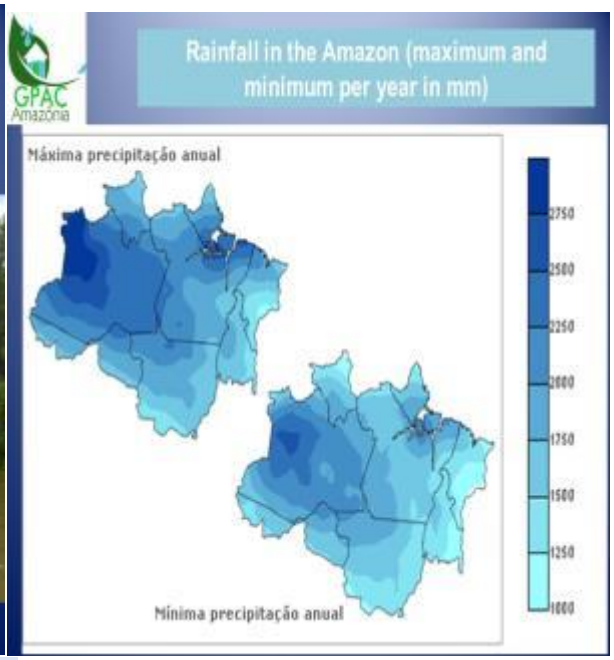
Reli-ability (%)	2000 Gal./Mth. Demand		3000 Gal./Mth. Demand		4000 Gal./Mth. Demand	
	Cayman Is.	St. Croix	Cayman Is.	St. Croix	Cayman Is.	St. Croix
50					0.5	2.0
55				0.5	1.5	4.0
60			1.0	1.0	2.5	7.0
65	0.5		2.0	1.5	3.5	10.0
70	1.0		3.0	2.0	4.5	b
75	1.0	0.5	4.0	2.5	5.5	b
80	1.5	1.0	5.0	3.0	7.0	b
85	2.0	1.0	6.0	4.0	10.0	b
90	3.0	1.5	7.0	5.0	18.0	b
95	4.0	2.0	8.0	b	b	b

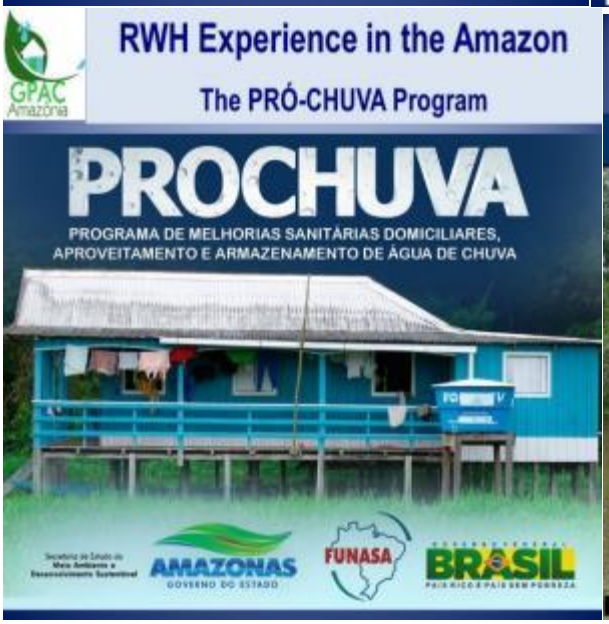
Required Storage for Various Monthly Demands in St. Croix and in the Cayman Islands

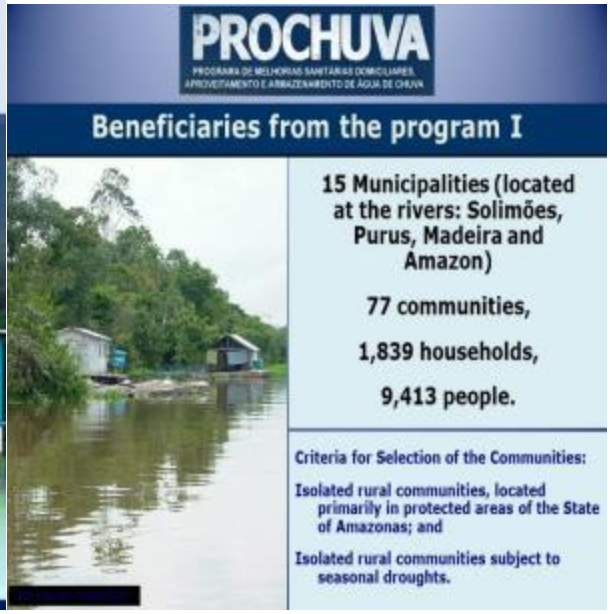


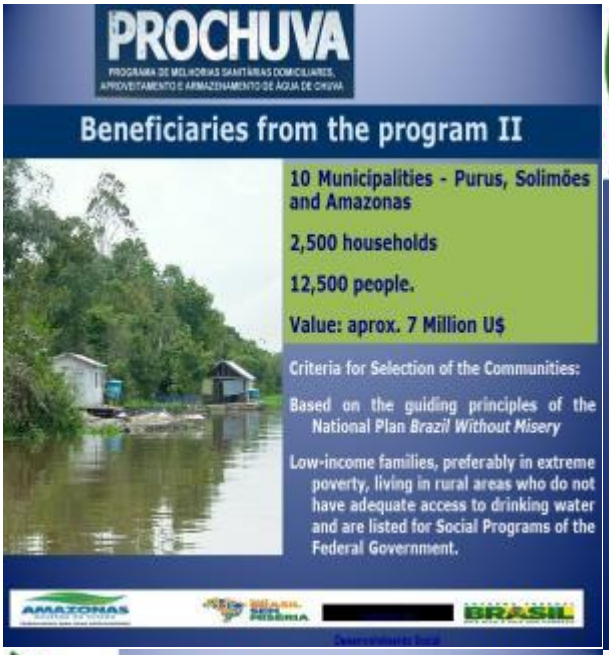
3.6: RWH in the Amazon. Dr. Norbert Fenzil (GPAC AMAZON)

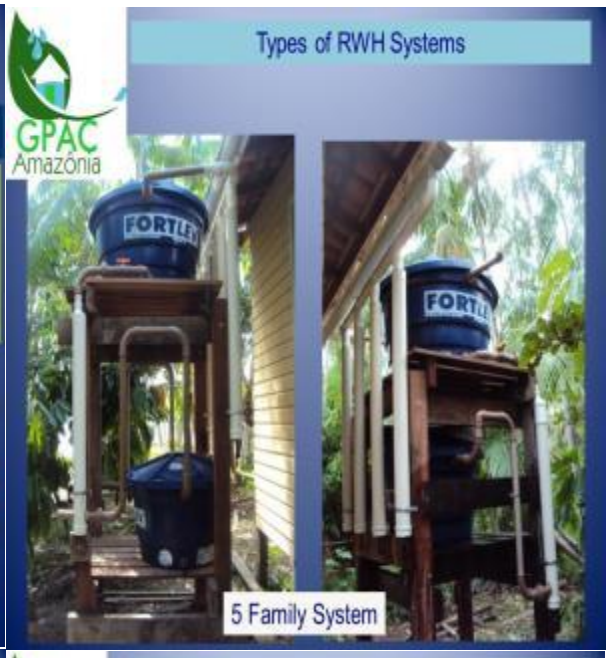

GPAC
Amazônia
Housing in the Amazon
Living on sweet water without safe drinking water


GPAC
Amazônia
Rainfall in the Amazon (maximum and minimum per year in mm)
Máxima precipitação anual
Mínima precipitação anual
2750
2500
2250
2000
1750
1500
1250
1000

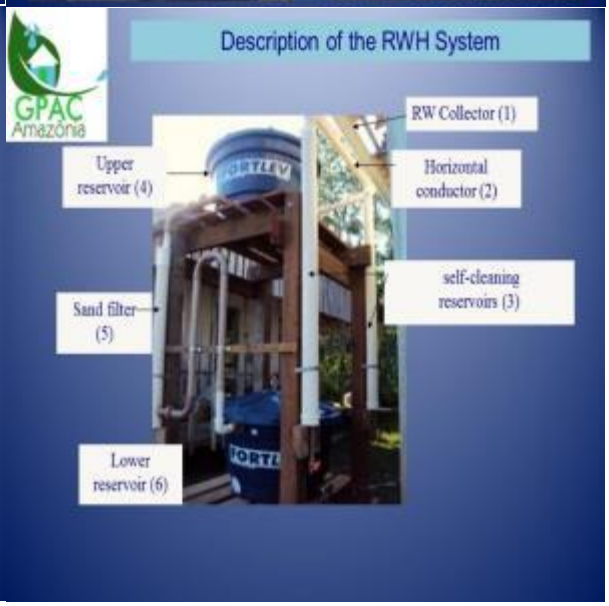

GPAC
Amazônia
RWH Experience in the Amazon
The PRÓ-CHUVA Program
PROCHUVA
PROGRAMA DE MELHORIAS SANITÁRIAS DOMICILIARES, APROVEITAMENTO E ARMAZENAMENTO DE ÁGUA DE CHUVA
AMAZONAS
GOVERNO DO ESTADO
FUNASA
BRASIL


PROCHUVA
Beneficiaries from the program I
15 Municipalities (located at the rivers: Solimões, Purus, Madeira and Amazon)
77 communities,
1,839 households,
9,413 people.
Criteria for Selection of the Communities:
Isolated rural communities, located primarily in protected areas of the State of Amazonas; and
Isolated rural communities subject to seasonal droughts.


PROCHUVA
PROGRAMA DE MELHORIAS SANITÁRIAS DOMICILIARES, APROVEITAMENTO E ARMAZENAMENTO DE ÁGUA DE CHUVA
Beneficiaries from the program II
10 Municipalities - Purus, Solimões and Amazonas
2,500 households
12,500 people.
Value: aprox. 7 Million U$
Criteria for Selection of the Communities:
Based on the guiding principles of the National Plan Brazil Without Misery
Low-income families, preferably in extreme poverty, living in rural areas who do not have adequate access to drinking water and are listed for Social Programs of the Federal Government.
AMAZONAS
BRASIL


GPAC
Amazônia
Types of RWH Systems
FORTLEV
5 Family System


GPAC
Amazônia
Types of RWH Systems
4 Family System


GPAC
Amazônia
Description of the RWH System
RW Collector (1)
Upper reservoir (4)
Horizontal conductor (2)
self-cleaning reservoirs (3)
Sand filter (5)
Lower reservoir (6)

3.7: RWH Projects in Central America. Marta Estrada and Rhona Diaz

Rainwater harversing projects in Central America

Fundación Solar – Guatemala. **Ing. Marta Cecilia Estrada**

Technological University of Panama. **Ing. Rhona Díaz, MSc.**

Fundación Solar, Guatemala

ENERGÍA RENOVABLE
LIMPIA POR NATURALEZA

Marta Cecilia Estrada López

5ta. Calle, 17-10, zona15,
Vista Hermosa I, Colonia El Maestro II
Ciudad de Guatemala
Guatemala.

Tels.: (+502) 2369 1081 / (+502) 2369 4482
fsolar@fundacionsolar.org.gt
www.fundacionsolar.org.gt

Who we are

Fundación Solar is a private development organization. It's born from the concern of a group of professionals, commited to Guatemala:

use of renewable energy, environment conservation, the strengthening of the local abilities and the base organization in rural communities.

Fundación Solar facilitates local development processes with gender equality and cultural pertinence, through:

- Promotion of the productive use of renewable energy
- Integrated water resource management (GIRH)
- Risk reduction management.
- Climate Change mitigation and adaptation..
- Governance, incidence and municipal strengthening.

ENERGY PROGRAM

- "Renewable energy, green by nature".
- Productive uses of renewable energy - dynamization of local economies and contributing to improve life quality.

Projects include:

- Community managed micro hydro power plants
- photovoltaic projects (on and off – grid).
- house illumination projects through biodigesters.
- energy efficiency (efficient cook stoves and bio gas)
- bio fuels

Political incidence and Energy – related Regulation promotion

- Law for the incentives for the generation with renewable energy
- inclusion of the Renewable Energy Distributed generation.
- Analysis and divulgation of the National Energy Policy 2013-2027.

Work Programs

Work Programs

WATER PROGRAM

Its purpose is to contribute in **improving knowledge and abilities** of the end users, communities, public and politicians, in a way that it allows the improvement of the actual conditions of governance and water management, to a local, national, and regional level, thus contributing to water security.

•Promotion of the society participation and involvement (governance).
•Strengthening of the institutionality for the Integrated Water Resource Management (GIRH) on municipal commonwealths, municipalities, and organized people in strategic watersheds
•political incidence to promote processes.

Facts about Rainwater harvesting in Guatemala

- No legal Framework surrounding the harvesting:
  - Municipality: Water use where the service is irregular or non existent (domestic)
  - Environment and Natural Resource Ministry and Other Joint-work programmes: Promote food security
  - No water law, however there are some regulations preventing from the profit and distribution of water

RWH systems in the urban (above) and rural (below) areas

Facts about Rainwater harvesting in Guatemala

- **Successes:** Local abilities created, empowerment, sensibilization about proper water use and crops, climate change mitigation and adaptation activities.
- **Challenges:** High costs, poor divulgation until recently, no monitoring of the water availability and supply. In some cases no training at all causing the dismissal of the systems.

Fundación Solar's RWH experience

GIRH- (Integrated water resources management) 2000-2008

- **Netherlands Embassy in Guatemala, MANCUERNA, Fundación Solar**
- High Naranjo River Watershed Commonwealth (MANCUERNA, in Spanish)
- Result: "generated and established abilities through rain water harvesting demonstrative actions, potable water projects implementation, forest tree nursery projects, the construction of wastewater treatment plants, and the management or auto regulation of tariff systems"
- 68 concrete water tanks were installed- 10,000 liters each for agriculture
- 213 families directly benefit from 2500 liter water deposits
- Training: Water use, soil conservation, crop diversification
- Local abilities created and strengthened

Fundación Solar's RWH experience

Project: Rain Water Harvesting in peri-urban areas in Guatemala City, 2014.

- **Joint work GWP – Guatemala, Gutemala City's Municipality, Fundación Solar, Neighborhood committees**
- RWH system for 2 public schools for sanitation purposes.
- 5 RWH for household use
- Peri-urban areas where the supply of this resource is irregular or non-existent.
- empowerment of teachers, students, parents, Unigue Neighborhood Committees (CUB in Spanish), auxiliary Mayors, and the Guatemala City Municipality
- 300 families benefit indirectly

Central America Projects

- **Guatemala, El Salvador, Nicaragua y Honduras**
  - Spanish cooperation funds for water and sanitation
    - 7 municipalities
    - Dry corridor
    - Construction of concrete reservoirs for water storage, for use in schools and agriculture

Universidad Tecnológica de Panamá

Ing. Rhona I. Díaz M.
Centro de Investigación e Innovación Eléctrica, Mecánica y de la Industria (CINEMI)
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(507) 290-8400 ext. 8492
www.cinemi.utp.ac.pa

RAINWATER HARVESTING IN PANAMA

FACTS

- Average annual rainfall of 1800-2000 mm
- 90% of population has access to potable water
- There is 4 month of dry season
- Climate change effect: extend of dry season to 5 month
- Many rivers are polluted

POLITICAL AND LEGAL FRAMEWORK

- There is a water law
- No policy framework for RWH
- Actual government is focus on provide water to the 100% of the population

PROJECT 1: Design and Construction of a rainwater harvesting system for an average urban house in Panama City

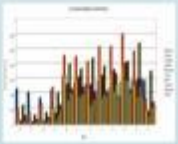
Organization: Technological University of Panama (www.utp.ac.pa)

Type: research

Goal: to design the optimum rainwater harvesting system for residences in urban areas of Panama City

Results:

- Average roof area: 80 m2
- Optimum tank size: 1800 liters
- Average cost (with pump system): 650.00$



PROJECT 2: Design of a compact rainwater harvesting for the semi-urban residential sector in Panama (toilet, laundry and irrigation)

Organization: Technological University of Panama (www.utp.ac.pa)

Type: research

Goal: to design a compact rainwater harvesting that does not need a pump for distribution.

Results:

- Tank size for daily use: 200 liter
- Use without adjust: laundry and irrigation
- Use with adjust: toilet

ACTUAL PROJECTS:

- Economic feasibility study of implementing a rainwater harvesting system at urban level in the city of Panama as a **state policy**.
- Evaluation of the roofs area available on the industrial and commercial buildings in Panama City to harvest rainwater using **GIS (Arc Gis)**.

Statal Project: RWH in rural schools

- **Organization:** Autoridad Nacional del Ambiente (National Autority of the Environment) (www.anam.gob.pa)
- **Type:** Development
- **Goal:** to implement RWH system in rural schools for hygienic and irrigation purpose

autoridad nacional del ambiente

Private Projects:

- Beach and Island hotels and residences
- Agropecuary sector

Central America Projects

- Costa Rica
  - Florida Bebidas. 10.000 liters system for an school
  - Universidad Nacional de Costa Rica (UNA). Agricultural sector. www.cedeme.una.ac.cr
    - Contact. Adolfo Salinas. asalinas@una.ac.cr
  - EARTH UNIVERSITY. Agricultural sector and buildings. http://www.earth.ac.cr

- http://www.fao.org/docrep/019/i0247s/i0247s.pdf

THANK YOU!

ING. MARTA ESTRADA – mc.estradalopez@Gmail.com

ING. RHONA DIAZ, MSC. – rhona.diaz@utp.ac.pa

3.8: RWH in the Mediterranean Islands: Cases and Lessons Learned. Konstantina Toli (GWP-Mediterranean)

Rainwater Harvesting in the Mediterranean Islands: cases and lessons learned

KONSTANTINA TOLI
Global Water Partnership - Mediterranean
Programme Officer - Head of European Union

RWH Knowledge Network Forum, Saint Lucia, Caribbean, 21-23 October 2014

GWP-Med Geographical Scope & current NCWR programmes

Key features
- Insular communities
- Severely water stressed
- Main economic activities: tourism and agriculture

Italy, Sicily (2014-2018) | Malta (2011-2015) | Greece, Cyclades & Dodecanese Islands (2008-on) | Cyprus (2013-2017)

Rainwater Harvesting & Non Conventional Water Resources Programmes in the Mediterranean

- A multistakeholder programme bringing together the Global Water Partnership-Mediterranean (GWP-Med), institutional stakeholders in the countries and the Coca-Cola Company/Coca Cola Foundation.
- Holistic approach resulting both to tangible outcomes towards joint local and regional sustainable development objectives and a new water culture.

Non Conventional Water Resources Programme in the Mediterranean

- RWH Programme in Greece (2008-on): partners: GWP-Med, the Coca-Cola System in Greece, Local Authorities in Islands
- Non Conventional Water Resources Programme in Malta - *Alter Aqua* (2011-2015): GWP-Med, Ministry for Energy & Health, Ministry for Gozo, Coca-Cola System in Malta,
- Non Conventional Water Resources Programme in Cyprus (2013-2017): GWP-Med, Ministry for Education, Coca-Cola System in Cyprus
- Climate Change Adaptation through Non-Conventional Water Resources Management in North Mediterranean (Greece, Malta, Italy, Cyprus, 2014-2018)

TOTAL BUDGET (2008-2018): 5,25 million USD, primarily Coca-Cola Foundation grants

Non Conventional Water Resources Programme in the Mediterranean

- Aims at promoting Non-Conventional Water Resources Management (NCWRs) and especially rain and stormwater harvesting and grey water reuse as cost effective practices for water availability and climate change adaptation at local level.

- The Programme's objectives are:
  - To demonstrate different RWH/NCWR techniques through pilot applications
  - To train teachers to educate students on NCWR, and increase awareness on sustainable water use
  - To enhance the capacity of the local authorities on NCWRM & IUWM
  - To train local technicians on the application of modern NCWR systems and materials, and build their capacity to install and/repair such systems and share their expertise at local level.
  - To promote multi-stakeholder partnerships for local NCWR initiatives.
  - To promote knowledge and sharing of experiences on aspects of integrated approached to urban water management.
  - To advance regional dialogue among Mediterranean countries on how to mobilise NCWR.

Global Water Partnership Mediterranean

Non Conventional Water Resources Programme in the Mediterranean

Global Water Partnership Mediterranean

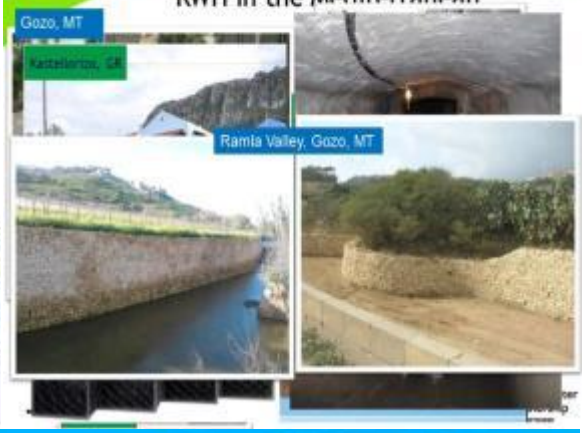
RWH in the Mediterranean

Rainwater harvesting in the Mediterranean islands is an ancient practice for water availability.

RWH is acknowledged as a non-regret measure for climate change adaptation at local level

- RWH Applications: Installation or reinstatement of innovative or traditional rainwater and stormwater harvesting systems in public buildings in urban and peri-urban areas, as well as in rural areas;
- Key elements: site specific, innovative, replicable solutions, adapted to local needs

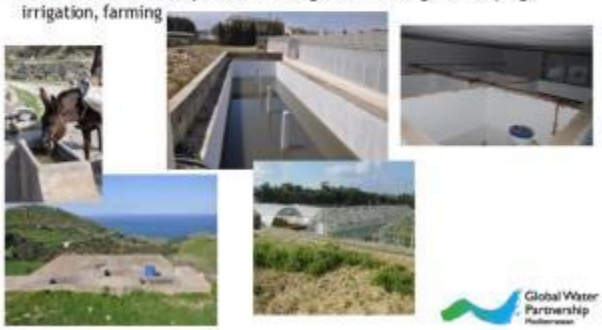
RWH in the Mediterranean



RWH in the Mediterranean

Monitoring: quantity control (analogue meters); quality control: not applied

Water reuse: secondary uses, including toilet flushing, landscaping, irrigation, farming



Global Water Partnership Mediterranean

RWH in the Mediterranean

Policy framework:

Greece: RWH is mandatory for water scarce islands (dependent on water transfers). Old houses used to have cisterns. All new buildings need to have a RWH reservoir; size relates to the surface area of the house- unfortunately not applied in many cases. Subsidies are not in place.

Malta: Revision of current water policy includes evaluation of RWH potential at domestic level. Based on current results, subsidies and other incentives will be considered through the *New Water Management Plan for the Maltese Islands*, coupled with demand management measures and utilization of other non conventional water resources (e.g greywater reuse)

Global Water Partnership Mediterranean

RWH/NCWR Med: Educational Activities

II. Educational and Training Programme:

- Educational material: country specific (Greece, Malta, Cyprus, Italy) developed by MIO-ECSDE/MEdIES and partners in the countries: Nature Trust Malta & Cyprus Pedagogic Institute; Educational Water Videogame
- Educational Programme for Students: Hands-on activities in kindergartens, primary schools and secondary schools
- Teacher training workshops
- Training for Technicians

RHW/NCWR Med Programme: Activities

III. Capacity Building, Awareness raising and dissemination of results

- Capacity Building workshops for local authorities
- Awareness raising activities for general public, including development of material: video game, video animations, flyers, facebook pages, school contests
- Experience & Knowledge sharing

RHW/NCWR Med Programme: Activities

IV. National and Regional Policy Dialogue on NCWRM

- Regional Conference on Advancing Non Conventional Water Resources Management in the Mediterranean (Sept. 2011, Athens)
- Contribution to the development of the National Water Management Plan for the Maltese Islands (under preparation)
- National Consultation on Non Conventional Water Resources Management (May 2014, Malta)

NCWR MED Programme: Figures*

- ✓ 3+1 Mediterranean countries
- ✓ 28 Greek Islands, 2 Maltese Islands and Cyprus
- ✓ 70.000 direct beneficiaries
- ✓ 10.000 students participated
- ✓ 1.200 teachers trained
- ✓ 225 technicians trained
- ✓ Installation of 24 RWH systems
- ✓ 2 stormwater management applications
- ✓ Reinstatement of 30 RWH systems
- ✓ Installation of 2 Grey Water systems
- ✓ Installation of 2 water kiosks (reverse osmosis systems for potable water)

*by June 2014

RWH & NCWR Programmes in the Mediterranean

Added Value & Highlights:

- ✓ Demonstrates innovative technologies in urban environment and advances the use of NCWR in the Mediterranean islands
- ✓ Applies NCWR technologies in public building and areas to demonstrate applicability of small and medium scale, that can be replicated at domestic level
- ✓ Develops educational and information material as water demand management tools to reach out to specific target groups (students, teachers) as well as general public promoting the use of NCWR
- ✓ Achieves international recognition for Water Initiatives (NCWRM in the Mediterranean Conference, Sept. 2011, Athens; 6th World Water Forum, March 2012, Marseille)
- ✓ Fosters regional dialogue to advance the use of NCWR and promote IUWM in the Mediterranean
- ✓ Promotes multi-stakeholder partnerships for local national and regional NCWR initiatives
- ✓ Creates a best practice with replication potential in the Mediterranean region as well as in other regions

RWH & NCWR Programmes in the Mediterranean

Lessons Learned:

- NCWR and especially RWH can be a solution to address critical development challenges due to water scarcity and climate change impacts
- National water policy often overlooks the RWH potential
- Financing is critical to advance RWH applications
- Need for multi-stakeholder partnerships and stakeholder engagement
- Need for education and awareness rasing for a new water culture

Opportunities

- Replication potential
- Knowledge sharing and networking
- Cross regional and inter-regional programmes-replication in other regions
- Innovation

Upscaling RWH in the Mediterranean: The *Rethink Athens* Project

-Transformation of the Athens city center for climate resilience: green infrastructure, parks, pedestrian zone
-Planned for 2016-17
-Budget: ~92mi Euros

Upscaling RWH in the Mediterranean: The *Rethink Athens* Project

- Modular tanks and a main reservoir for RWH
- Collects stormwater & rainwater
- Decreases the flush flood risks
- Installed capacity: 14,000m³
- RWH yield: ~ 24,000m³/yr
- Covers 100% of the watering needs for all new plantation for the whole year, making the project water neutral

Thank you for your attention!

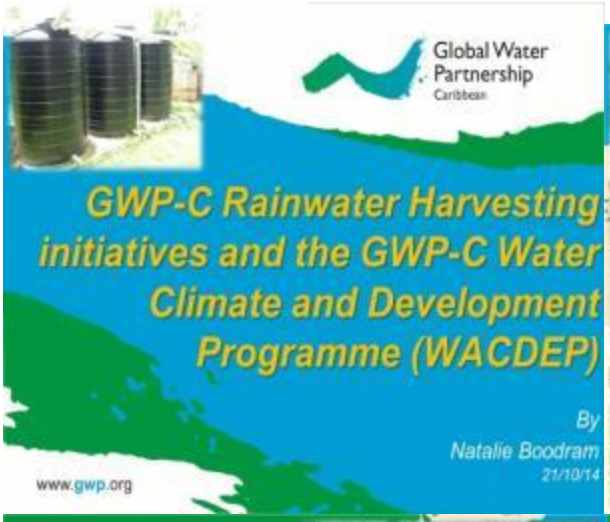
For more information:

www.gwpmed.org

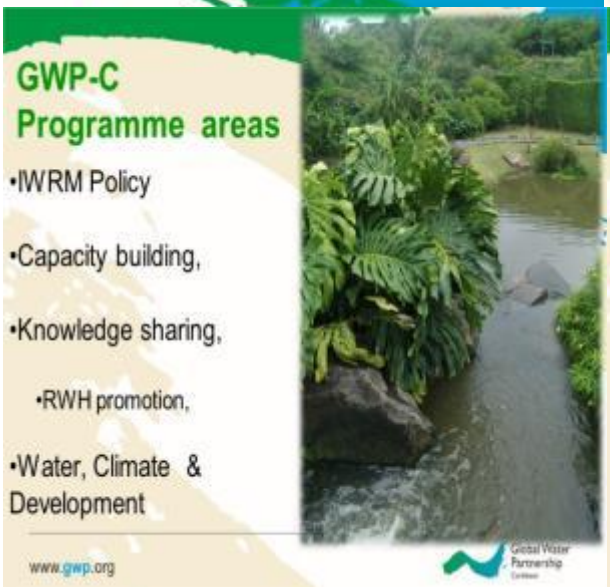
Email: konstantina@gwpmed.org
secretariat@gwpmed.org

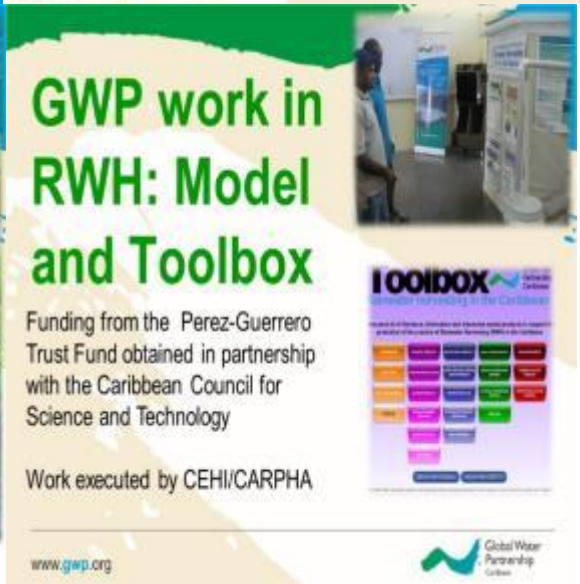
AlterAqua
Mission Water Cyprus

3.9: GWP-C RWH initiatives & GWP-C Water Climate and Development Programme. Natalie Boodram (GWP)

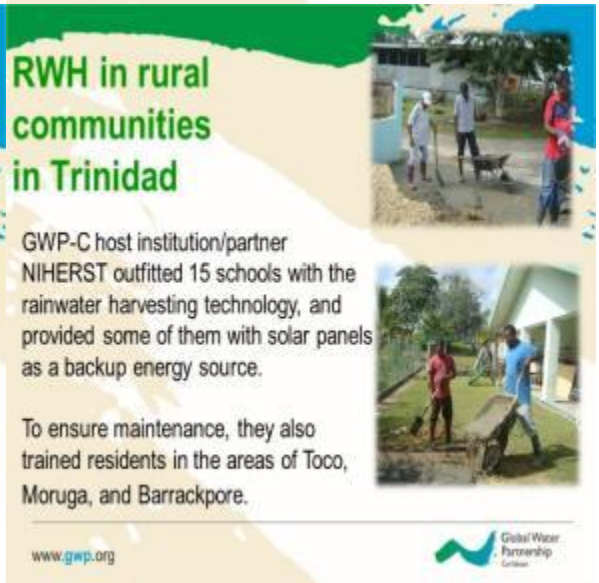

Global Water Partnership
Caribbean
GWP-C Rainwater Harvesting initiatives and the GWP-C Water Climate and Development Programme (WACDEP)
By
Natalie Boodram
21/10/14
www.gwp.org


What is the Global Water Partnership-Caribbean (GWP-C?)
www.gwp.org


GWP-C Programme areas
•IWRM Policy
•Capacity building,
•Knowledge sharing,
•RWH promotion,
•Water, Climate & Development
www.gwp.org


GWP work in RWH: Model and Toolbox
Funding from the Perez-Guerrero Trust Fund obtained in partnership with the Caribbean Council for Science and Technology
Work executed by CEHI/CARPHA
www.gwp.org


RWH Model
Model first displayed in 2010 in Grenada/CWWA
Portable travelling model featuring rain simulation, information panels, first flush diverter system
Since displayed throughout Trinidad e.g. NIHERST Science Fairs
Adopted and modified in Jamaica by WRA
www.gwp.org


RWH in rural communities in Trinidad
GWP-C host institution/partner NIHERST outfitted 15 schools with the rainwater harvesting technology, and provided some of them with solar panels as a backup energy source.
To ensure maintenance, they also trained residents in the areas of Toco, Moruga, and Barrackpore.
www.gwp.org

RWH Toolbox

- A resource kit of literature, information and interactive Media products to support the promotion of the practice of Rainwater Harvesting (RWH) in the Caribbean
- Outputs of this workshop to update the toolbox: We want info!

Toolbox
Global Water Partnership Caribbean
Rainwater harvesting in the Caribbean

www.gwp-caribbean.org

www.gwp.org

Global Water Partnership

RWH Publications

Flashdrives available with publications including Sourcebook and information briefs on building climate resilience within the Caribbean water sector

www.gwp.org

Global Water Partnership

RWH Demos

In discussions for demo sites in Guyana hinterland

www.gwp.org

Global Water Partnership

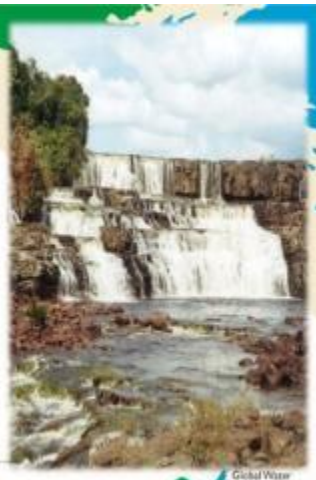
RWH under the GWP-C Water Climate and Development Programme (WACDEP)

www.gwp.org

Global Water Partnership

Water, Climate and Development Programme (WACDEP)

Goal: To promote water security and climate resilience in Caribbean States as a key part of sustainable regional and national development for economic growth and human security.



www.gwp.org

WACDEP – Regional Framework

- Executed in partnership with CCCCC
- Aligned to the CARICOM Regional Implementation Plan for Achieving Development Resilient to Climate Change

RWH as a low/no regret investment to build climate resilience in the Caribbean Water Sector

- A technique to augment existing potable municipal supplies, and as a readily accessible emergency source of water in case of natural disasters like hurricanes and floods, which may disrupt access to the main municipal water supply.

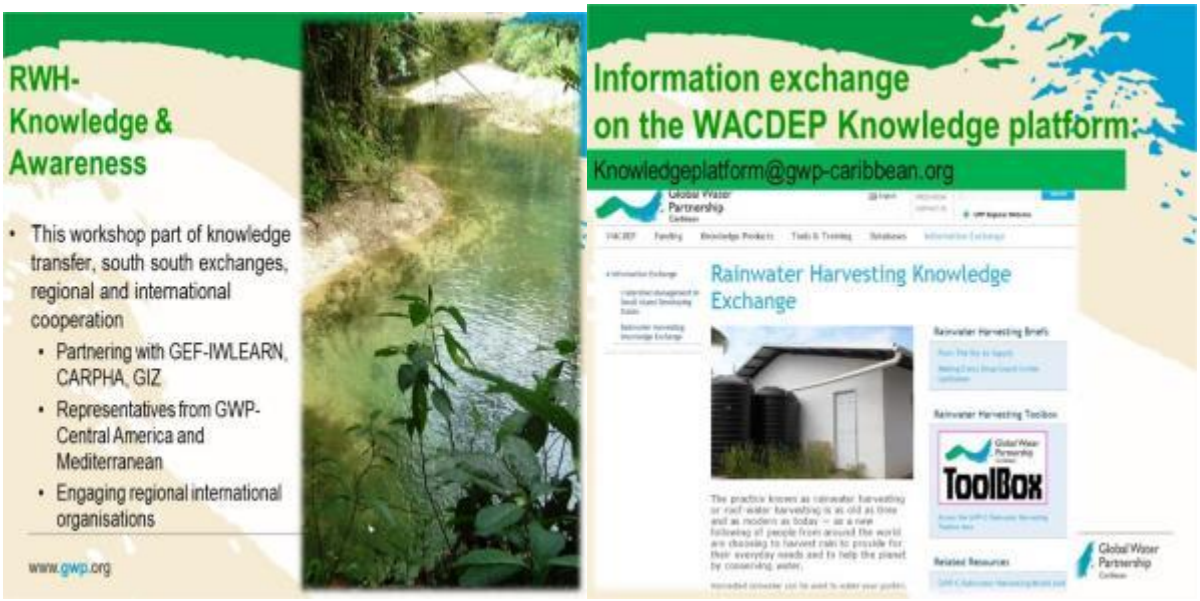
www.gwp.org

WACDEP has 8 generic work packages common to all GWP regions

- Knowledge and Awareness
- Capacity Development,
- No/Low Regret Investments
- Project Preparation and Financing
- Demonstration Projects
- Governance and Fundraising
- National Plans, Policies and Strategies
- Regional Cooperation in Water Management

Tailored to Caribbean Context

www.gwp.org



3.10: Commercial Scale RWH, Case Studies from the Barbados Experience. Andrew Hutchinson (Stantec Caribbean)

Commercial Scale RWH

Case Studies from the Barbados Experience

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by Andrew P. Hutchinson, P.Eng
Senior Principal, Stantec Caribbean

RWH Knowledge Network Forum,
Bay Gardens,
St Lucia.
October 21, 2014

Stantec

Commercial Scale RWH – Case Studies from Barbados
Introduction

- GLOBAL WATER PERSPECTIVE
- BARBADOS WATER RESOURCES & INFRASTRUCTURE
- OPPORTUNITIES FOR CONSERVATION MEASURES
- RWH – REGULATORY INITIATIVES
- RWH – TECHNICAL ANALYSIS
- RWH – FIVE CASE STUDIES
- CONCLUSIONS

Commercial RWH – Case Studies from Barbados
Global Water Perspective

- Global Water – 97% Seawater – 2% Polar Icecaps – 1% Useable
- "Water Stressed" Regions – 2.0 billion people (<1,700 cm/p/yr)
- "Water Scarce" Regions – 1.2 billion people (<1,000 cm/p/yr)

- No access to water for sanitation – 2.4 billion people
- Annual Deaths from Waterborne Diseases – 2.2 million people; mostly children < 5 years age (2007 UN World Water Day)
- World Population – 2.5 billion (1950) to 6 billion (2000) - up 150%
- Urban Population – from 29% to 47% in 50 years (1950-2000)
- US Bottled Water Industry value now US$12 billion (The Economist)
- Privatized Water in USA now US$400 billion (Worldwide business)
- Investment in US Water & Wastewater Technologies rose 433% (2006-2007) – (Forbes)

Stantec

Commercial RWH – Case Studies from Barbados
Geology & Ground Water Units

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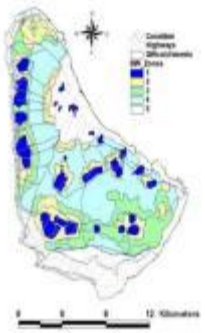
Commercial RWH – Cast Studies from Barbados
Ground Water Protection Zones

- H. Tullstrom introduced Protection Zones in 1963.
- Zone 1: 300 days travel time; 9% or 3,927Ha (9,700 acres); no development allowed.
- Zone 2: 600 days travel time; 13% or 5,590Ha (13,807 acres); dev. with Septic Tanks + suck well.
- Zone 3: 5-6 years travel
- Zone 4: All highland areas.
- Zone 5: Coastal areas.



Commercial RWH – Case Studies from Barbados
Water Scarcity or Poor Resource Use?

- "Water Scarce Country" - renewable water resource <1000 cm / person / year (UN 1990's)
- Barbados ~ 210 cm /person/year (2009)
- St. Lucia ~ 5,500 cm /person/year (2000)
- Trinidad ~ 4,200 cm /person/year (2000)
- BWA Average Daily supply 159k cm/d ~ 58M cm/yr.
- 1016mm Rainfall ~ 435M cm/yr (BWA utilization = 13.3%)
- 1270mm Rainfall ~ 549M cm/yr (BWA utilization = 10.5%)
- 1524mm Rainfall ~ 655M cm/yr (BWA utilization = 8.8%)
- Evapotranspiration Rates ~ 1,220mm to 1,829mm /year

- Question – Are we really water scarce or just complacent ???

Commercial RWH – Case Studies from Barbados
Barbados Water Infrastructure

- **WWD started 1861** – Benn Spring + Standpipes, Cod. College.
- **BWA Statuary Authority** - since Oct 1980 for Water + Wastewater; Since April 1, 1981 BWA supplies 98% population with tap water
- **Water Mains** – 2,600 km (1,600 miles).
- **GW Sources** – 2 Springs + 17 Sheet Water Wells + 5 Stream Water Wells + 7 Boreholes – 159k cm/d (42M USGPD) + 120 Private Wells – 36.4k cm/d (9.6M USGPD)
- **RO Desalination Plant** (2001) - 30,000 cm/d (7.9M USGPD)
- **Bridgetown WTP** (1980) – 2.5M USGPD + 4 Sewage PS + 1 Sea Water PS + 500mm diameter x 300m marine outfall 15m water depth.
- **Graeme Hall WTP** (1997) – 6.0 M USGPD + 5 Sewage PS + 1.2km marine outfall in 36m depth.

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Commercial RWH – Case Studies from Barbados
Opportunities for Efficiency Gains

- **Reduce UFW** – 60% lower to 40%, save 32,196 cm/d.
- **Meters Replacement & Maintenance** – 105,000 meters; most >15 Years old & under recording flows.
- **Hydraulic Model** - to optimize pipe sizes in network – identify weak links.
- **Mains Replacement** – after identifying deficiencies in system.
- **Restructure Employment & Industrial Practices** – excessive overtime, billing irregularities, absenteeism.

Commercial RWH – Case Studies from Barbados
Consumers Role – "Respect for Water"

- **Conservation** – through water saving fixtures: spring loaded taps, monitor meters for leaks.
- **Rain Water Harvesting** – irrigation, car washing, WC flushing, laundry, mopping, swimming pool; 429M cm/yr lost in 50" Rainfall Year.
- **Respect Value of Water** – Domestic = 0.25/0.77cent/Liter; Commercial = 0.466 cent / Liter; Cruise Ships = 0.81 cent / Liter.

- **Water Toilet** – John Harrington (1596); J.F. Brondel (1738) with valve; J. G Jennings (1852) patented pan with water trap.
- **WC's** – 110k BWA customer connections; 350k WC's on line 24/7
- **WC Flushing** – 26% to 30% domestic use; 18,940 cm/d or 12% BWA supply.
- **Overflowing WC Cisterns** – faulty flapper valve; 1% WC's waste >20,000 cm/.d

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Commercial RWH – Case Studies from Barbados
Town & Country Planning Policy Initiative

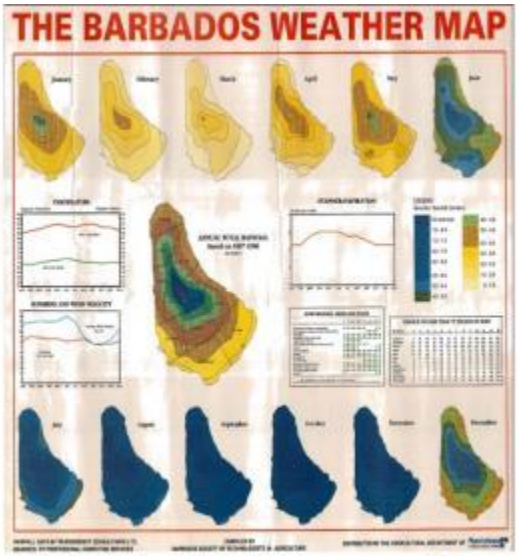
- **Jan. 1996** – Planning applications; Rain Water Tanks
- **Aug. 1997** – Planning requirement revised (roof area ?)

- **Domestic:** 1,500 – 3,000 SF floor (tank 3,000 Imp gals)
- **Domestic:** >3,000 SF floor (tank 6,000 Imp gals)
- **Commercial:** 4.0 Imp gals per SF of roof area.
- **Enforcement:** No Tank / No Permit Approval ??
- **Policy Success:** Tanks built, not all used effectively !!!

POLICY INITIATIVE: Mandatory rain water tanks for flushing toilets on commercial projects; industry, hotels, offices etc.; + fiscal incentives for hardware.

Commercial RWH – Case Studies from Barbados
Available Data for Rain Water Harvesting

- Rainfall Data – monthly average since 1847.
- Rainfall I/D/F Maps (J.F. Lirios, Nov. 1971)
- Topo / Watershed Maps – 1:10,000 scale
- B'dos Geology Map
- Eavpotranspiration data – Met Office.
- Rainfall Stats – CIMH, Husbands, St. James



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Commercial RWH – Case Studies from Barbados
Water Balance Analysis

- **Irrigation Requirement** = water to make up soil moisture deficit.
- **Identify Watersheds** for Harvesting – compute runoff.
- **Select Rainfall Event** – 45"Yr; 51"Yr, 60"Yr etc.
- **Model computes monthly Water Balance.**
- **Select pond volume** needed to sustain system – trial & error.

Commercial RWH – Case Studies from Barbados
Millennium Heights Complex, St. Thomas

- Residential Sub-division 45 Acres (built in 2000)
- Phase 1 – 78 Condos& Villas
- Phase 2 - 20 Duplex + 16 Condos + 64 free hold Lots.
- Existing Sinkhole converted to 1.5 acre, 5.5 M gal. lined pond.
- Improved aesthetics and property values + irrigation
- Exceeds TCDPO regulatory requirements for Rain Water Storage.

Commercial RWH – Case Studies from Barbados
Lion Castle Polo Estate, St. Thomas

- 64 Acres Residential 2003 Sub-division + Polo Field.
- Required non-potable water for irrigation of 12 acre polo field Jan – May.
- Existing Sinkhole converted to 6.0 M gal. lined pond with overflow to Suck Well.
- Harvested Watershed – 40 Acres = polo field + roads + paddock + home sites.

Commercial RWH – Case Studies from Barbados
Lion Castle Polo Estate, St. Thomas

Commercial RWH – Case Studies from Barbados

Mount Gay Distilleries, St. Lucy

- Rum Ageing & Blending Facility on 12 acre site.
- Completed 2005
- Four buildings + paved areas
- Existing Sinkhole converted to 3.0 MG. lined pond for irrigation + fire fighting reserve.
- Overflow to Suck Well.
- Exceeds TCDPO rain water storage requirements.

Commercial RWH – Case Studies from Barbados

Farmers Water Impoundment, St. Thomas

- 220m L Dam; crest +250m, Invert +243m, TWL +248m
- Watershed area 246 acres.
- 68 M gal. pond; flooded area 15 acres.
- Overflow 5m x 5m + 2.4m x 2.4m outlet culvert.
- Pump capacity 1.0 MGPD via 1.3 miles of 250mm pipe to Apes Hill to irrigate 18 hole golf course.
- Completed May 2006.

Commercial RWH – Case Studies from Barbados

Farmers Impoundment – Before Construction

Commercial RWH – Case Studies from Barbados

Farmers Impoundment – After Construction

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Commercial RWH – Case Studies from Barbados

Kensington Cricket Oval, St. Michael

- Cricket Stadium since 1895
- Reconstructed for CWC2007
- Integrated Drainage & Irrigation Solution.
- Watershed ~ 7.5 acres.
- Field + Roofs drainage in perimeter "French Drain" with 230 Storm Chambers in 418m L x 3.0m W x 1.5m D trench.
- On site ground water well provides brackish water for irrigation.

Commercial RWH – Case Studies from Barbados

Other Projects in Progress

- River Plantation – 500 acres, irrigation/drainage control for farming.
- Lancaster Golf Course – irrigation + water reuse.
- Lears Impoundment – irrigation/drainage control.
- Industrial Facilities – non potable water uses.
- Development of East Coast Watersheds – non potable for farming use etc.

Commercial RWH – Case Studies from Barbados
Unused East Coast Watersheds – More Water

- Haggatts, St. Andrew ~ 3,469 acres
- Joes River Plantation, St. Joseph ~ 1,015 acres
- Greenland, St. Andrew ~ 1,110 acres

- Turners Hall/Swan's, St. Andrew ~ 1280 acres
- Bawden's North, St Andrew ~ 356 acres

- All East Coast Watersheds, high rainfall areas in Scotland District area – impermeable clay & shales, high runoff.

POLICY INITIATIVE: Initiate planning for development of East Coast Watersheds; farming benefits; water augmentation.

Commercial RWH – Case Studies from Barbados
Water Conservation Measures ??

- Reduce WC Cistern Leakage ~ 7.5 MGPD (save17.8%)

- Reduce "Unaccounted for Water" from 55% to 35% - (Save 8.0 M USGPD or 19% of current daily pump rate)
- Update Operations - flow controls systems at pump stations.
- Establish National Pressure Zones – hydraulic model.

- Tariff Review - implement water tariffs that reward conservation.
- Reward Rain Water Harvesting - for secondary use, toilet flushing, landscape irrigation, gardening, pools etc..

POLICY INITIATIVE: Mandatory retrofitting of flapper valves on American water toilets + fiscal incentives for rain water harvesting.

Commercial RWH – Case Studies from Barbados
Recommended Regulatory Policy Initiatives

- FTC - Set targets to reduce "UFW" 62% to 35% - save 8M USGPD.
- FTC – Accountability for reliability of meters in system.

- Provide incentives for Low Flow water use fixtures and retrofitting of Toilet Cisterns Valves, save ~ 7.5M USGPD.
- Implement Water Tariffs that Reward Conservation.

- Incentives for RWH – for all non potable uses + mandatory commercial toilet flushing ~ 4M USGPD.
- Fiscal Incentives for development of East Coast Watersheds – farming benefits, water augmentation, etc..

- Public Education – leak management, conservation, RWH.

Commercial RWH – Case Studies from Barbados
Who will rescue our Civilization ?

"The person that solves the water problem deserves two Nobel Prizes for their contribution to improved health and food production"

By John F. Kennedy

This is still true in 2014 – 50 years later

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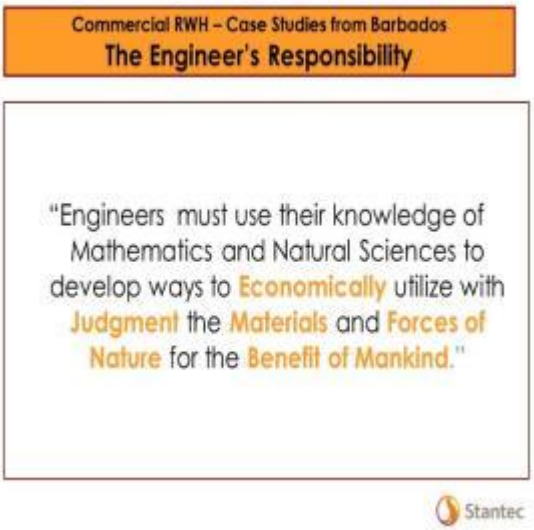


3.11: Overview of RWH in Agriculture. Lystra Fletcher-Paul (FAO)

An Overview of Rainwater Harvesting Initiatives in Agriculture

L.M. Fletcher-Paul
Deputy Sub-Regional Coordinator/
Land and Water Officer
FAO

OUTLINE

- Introduction
- FAO's work in Rainwater Harvesting
  - Feasibility Studies
  - Pilots and Demonstrations
  - Tools and Guidelines
  - Capacity Building
- Challenges
- Lessons Learnt
- Conclusions and Recommendations

INTRODUCTION

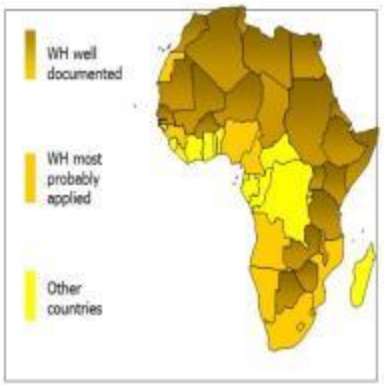
RWH has been practised for a long time:

Asia
- **Jordan** (since 7000 BC)
- **Mesopotamia** (4500 BC)
- **Palestine** (2000 BC-1200 AD)
- **Yemen** (since 1000 BC)
- **Pakistan**
- **India**
- **Sri Lanka**
- **China**

America
- **Arizona and New Mexico** (1000 AD)

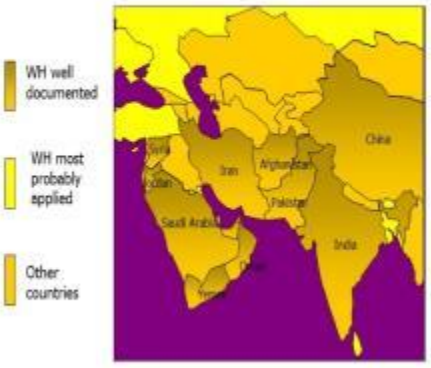
Africa
- **Tunisia**: 'Meskets', 'M'goud' and 'Jessours'
- **Somalia**: 'Caag' and 'Gawan' systems
- **Sudan**: 'Haffire', 'Teras' etc.
- **Burkina Faso**: Pits

Where is water harvesting used at present in Africa ?

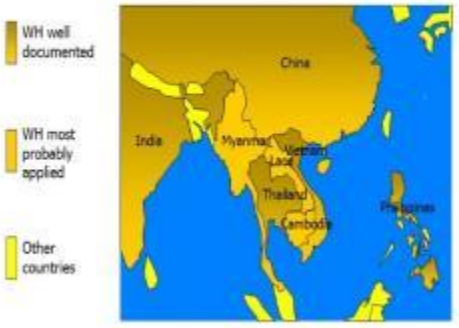


Examples:
Morocco
Algeria Egypt
Chad
Mali
Niger
Sudan
Ethiopia
Somalia
Kenya
Tanzania
Zambia

Where is water harvesting used at present in Asia? (I)



Where is water harvesting used at present in Asia ? (II)



FEASIBILITY STUDIES

- St Kitts and Nevis – *Brace Centre for Water Resources Management, Mc Gill University (2007)*
- Antigua and Barbuda, Barbados, Grenada, Jamaica, Dominica and Montserrat – *CDB/FAO/IICA/Gansu Research Institute for Water Conservancy, China (2008)*

Pilots and Demonstrations

Promoting Rainwater Harvesting in South St. Elizabeth

To improve the management of water and the overall productivity of small farmers in South St. Elizabeth

Promoting rainwater harvesting ... (Cont'd)

Promoting rainwater harvesting ... (Cont'd)

Results Achieved

- increased crop yields,
- improved crop quality,
- improved land productivity,
- extended growing seasons,
- improved capacity to introduce new crops,
- reduced reliance on truck-borne water

Results Achieved

- Reduced cost of production,
- increased individual access to irrigation water,
- increased water use efficiency
- contribution to personal and national food security
- increased socio-economic well being of the farmer.

Other Rainwater Harvesting Systems

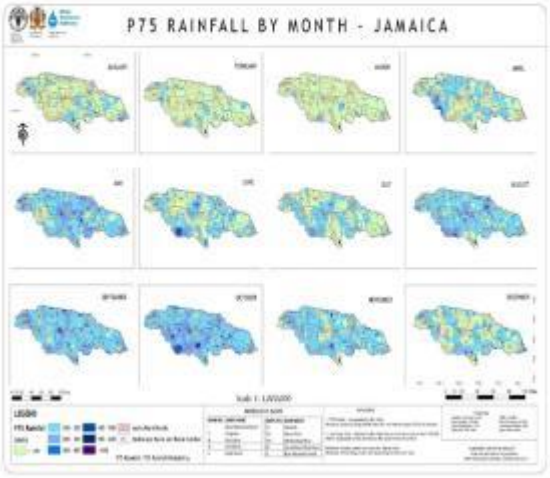
Other Rainwater Harvesting Systems

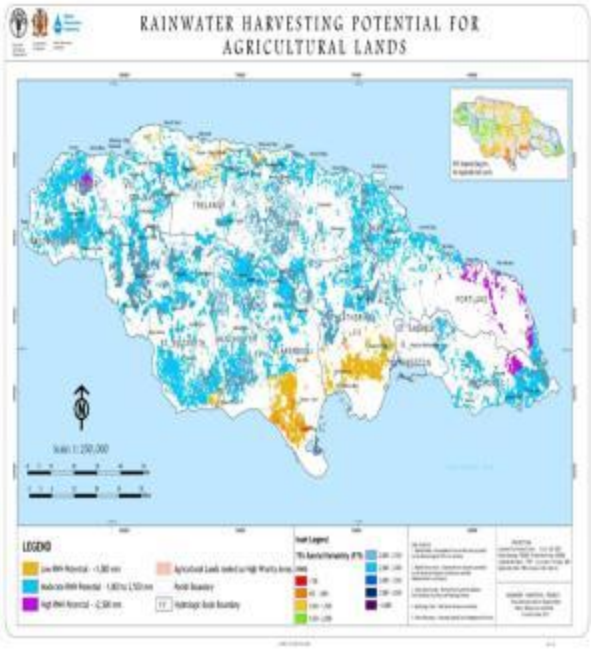
Other Initiatives

- Storm Drains – Antigua and Barbuda
- Micro dams – Antigua and Barbuda

Tools and Guidelines

GIS Water Deficit Maps





Limitations of GIS tool

- ❑ Does not give RWH Potential per crop type (crop type data unavailable)
- ❑ Data Coverage and Time Period
  a. Landuse Data is from 1984
  b. 8% Soils Data missing
- ❑ Some rainfall maps do not depict seasonal variations
- ❑ Agricultural Water Demand and Evaporation Maps are done per hydrologic basin, not per station (gives the impression of uniformity throughout the basin)

Tools and Guidelines

- RWH Methods for Agriculture in the Caribbean Sub-Region
- RWH Training CD – Training course in water harvesting (*Land and Water Digital Media Series 26*)
- RWH Manual prepared by RLC – Captacion y Almacenamiento de agua de lluvia

Capacity Building

- Workshop on RWH technologies - Antigua and Barbuda – 2009
- Training Workshops – Jamaica 2011
- Sustainable Crop Production Intensification Workshop – Barbados 2012
- National Workshop on Water Management Strategies for Climate Smart Agriculture – Antigua and Barbuda, 2013

Challenges

- Water for domestic use – a priority for the household
- Crops to be grown during extended growing season
- Farmers' knowledge of new crops
- Climate risks
- Limited experience of Extension service
- Siltation of microdams
- Pollution
- Larger schemes and structure are difficult to implement

Lessons Learnt

- Farmer selection is important
- Site selection important including tenure
- Involve the farmer in all stages
- Rainfall, hydrological data
- Link markets to production
- Holistic approach to crop husbandry
- Support services important – extension, credit, etc

Conclusions

- Rainwater harvesting for agriculture is not new
- It is an important Climate Smart Technology
- Much work has been done in the Caribbean
- GIS mapping is a powerful planning tool
- There are many benefits, but it depends on other factors – e.g. markets, information, site, support
- Capacity building and partnerships are essential

Thank you!!

3.12: Water Safety and RWH. Christopher Cox (CARPHA)

Water safety and Rainwater Harvesting

Rainwater harvesting (RWH) Knowledge Network Forum

Dr. Christopher Cox,
Caribbean Public Health Agency (CARPHA)
21st to 23rd October 2014,
Bay Gardens Inn, Saint Lucia

CARPHA Preventing disease, promoting and protecting health

Water safety
Main areas of focus

- In respect to drinking purpose in particular
  - Reducing contamination to the storage that comes from the catchment
  - Reducing contamination that may enter the storage via other means
- In respect to vector-borne disease proliferation
  - Reducing opportunity for mosquito breeding

CARPHA Preventing disease, promoting and protecting health

Minimizing contamination from roof/catchment
Cleaning of roof

- Roof surface must be clean and inert
  - Reduced chance of harmful organisms, avoid leached chemicals
- Avoid dirty and clogged gutters
  - Clear away overhanging branches
  - Install gutter screens

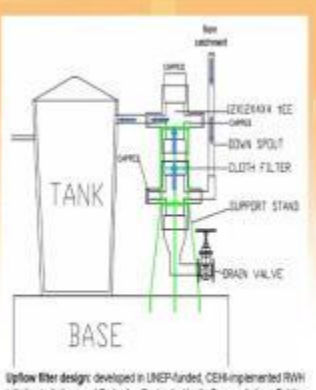
CARPHA Preventing disease, promoting and protecting health

Minimizing contamination from roof/catchment
First-flush diversion

- How it works....

CARPHA Preventing disease, promoting and protecting health

First-flush diversion Antigua and Barbuda



Upflow filter design: developed in UNEP-funded, CEHI-implemented RWH initiative in Antigua and Barbuda. Design by Hastin Barnes, Antigua Public Utilities Authority, 2008

CARPHA Preventing disease, promoting and protecting health

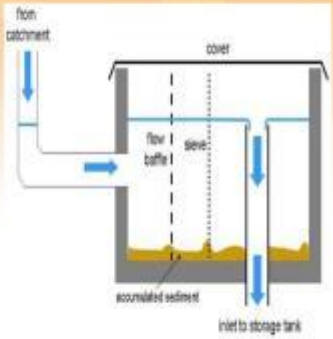
Do-it-yourself

- Constructing a first flush diverter using off-the-shelf materials

CARPHA Preventing disease, promoting and protecting health

Minimizing contamination in storage

- Introducing a baffle tank before the storage
- Clean/de-sludge the storage tank



CARPHA Preventing disease, promoting and protecting health

Chlorine dosing

- Adding household bleach to tank
- Use correct dosing
- Challenge for dosing black tanks based on estimating water volume
  - Need for easy way to read tank level

Volume of water in tank			Approximate amount of bleach (with 4% active ingredient)
Imp. gallons	US gallons	Litres	(cups)
200	240	909	½
400	480	1,818	1
600	720	2,727	1½
800	960	3,637	2
1,000	1,200	4,546	2½
2,500	3,000	11,365	5½
5,000	6,000	22,730	11½
10,000	12,000	45,461	22½
20,000	24,000	90,922	45½

CARPHA Preventing disease, promoting and protecting health

From storage to end use

- Filters - Screen for solids, macro pathogens
  - Cloth, charcoal filters
  - UV filters
- Old stand-by....boiling!!

CARPHA Preventing disease, promoting and protecting health

Controlling mosquito breeding

- Need to reduce dengue, chikungunya risk
- Water hoarding is perhaps contributing to current outbreaks
  - Vector breeding in storage tanks

Source: Louisiana State University Agricultural Center

CARPHA Preventing disease, promoting and protecting health

Dec 13 2013

Jan 20 2014

Feb 26 2014

Apr 14 2014

Apr 26 2014

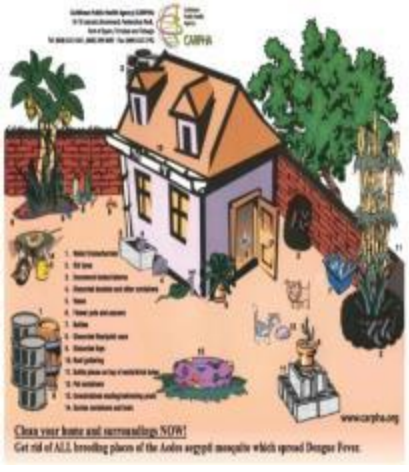
Jun 2 2014

Jun 30 2014

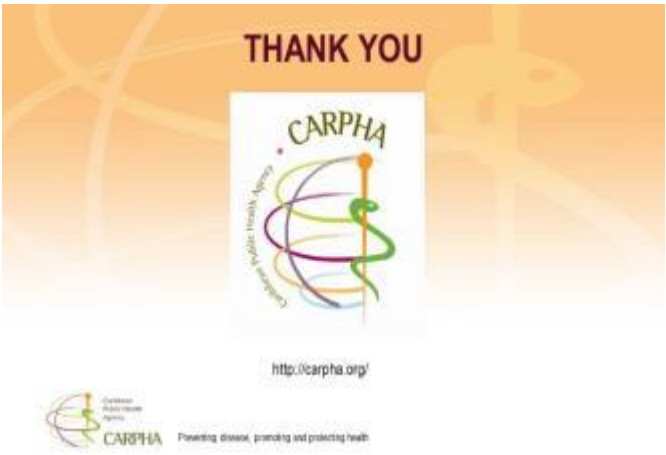
Chikungunya Update #36: October 6, 2014

- To date, 13,006 confirmed/probable cases reported across the region.
- 1,870 cases reported from 22 of the 24 CARPHA Member States (CMS)
- 11,136 cases from 11 other countries/territories

- CARPHA website: http://carpha.org/What-We-Do/Public-Health-Activities/Chikungunya



Spend 10 mins a week and use this chart to inspect your yard and get rid of or cover ALL breeding places for mosquitos!



3.13: Regional RWH Programme. Christopher Cox (CARPHA)

Regional Rainwater Harvesting Programme

Rainwater harvesting (RWH) Knowledge Network Forum

Dr. Christopher Cox,
Caribbean Public Health Agency (CARPHA)
21st to 23rd October 2014,
Bay Gardens Inn, Saint Lucia

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Programme objectives, outcomes

- Objective
  - *Contribute to the conservation of the water resources of Small Island Caribbean States through adoption of sustainable water management and conservation technologies.*
- Outcome
  - *Capacity for implementation of rainwater harvesting for household and commercial purposes strengthened and support policies and incentives developed and mainstreamed into national development strategies and policies*

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National level actions

- Component 1: Awareness Raising
- Component 2: Capacity Building
- Component 3: Legislative and Policy Formulation
- Component 4: Infrastructural Development

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Component 1: Awareness Raising

- Objectives
  - To enhance positive public awareness on the practice of RWH
- Key actions
  - Workshops and seminars for public and policy makers
  - Radio public service announcement productions (excluding broadcast cost)
  - Video feature productions (excluding broadcast cost)
  - Printed material production
  - Website development and management
  - School awareness programme (primary and tertiary levels)
  - Public and commercial house surveys
  - surveys (annually and at end of programme)

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Component 2: Capacity Building

- Objectives
  - To develop and improve national competency in developing (design and construction) and operating RWH systems
- Key actions
  - Technical training seminars.
  - Training workshops on operation and maintenance of RWH systems (communal RWH systems).
  - Technical exchanges.

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Component 3: Legislative and Policy Formulation

- Objectives
  - To promote integration of RWH within national IWRM plans through policy and legislative reform
- Key actions
  - Legislative and policy reviews
  - Design incentive regime for RWH
  - Stakeholder workshops

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Component 4: Infrastructural Development

- Objectives
  - To optimize RWH systems to increase the quantity and improve quality of water
- Key actions
  - Stakeholder consultations
  - Technical studies
  - Project development & funding procurement
  - Training workshops - O&M for new investments

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Regional level actions

- Formal ratification and endorsement of a lead regional agency for the promotion of the regional RWH strategy;
- Get recognized at regional level (COTED age; environment; health); link to post MDGs development agenda; SAMOA Pathway – 2nd Qtr 2015
- Establish partnership arrangements with relevant Caribbean agencies to strengthen outreach and advocacy efforts; assist with resource mobilization in execution of various components of the regional strategy;
  - Joint MOU among agencies, include south-south cooperation; to be drafted for circulation – IWECO and IWLEARN Phase 4 to assist; draft by 1st Qtr 2015
- Development of a website for the capture and dissemination of best practices in RWH;
- Development of a toolkit by the GWP to be included as an additional educational resource;
- Promotion of the RWH initiative through integration with the irrigation support components of the regional FAO School Feeding and School Gardening programmes;

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Regional level actions *(cont'd)*

- Collaboration and coordination with the Government Information Services of the respective territories to assist with the national broadcast of the public awareness programmes;
- Coordination of monitoring of the level of success of national RWH programmes;
  - Link to the MOU; make part of role of partners
- Negotiate with the Caribbean Water and Sewerage Association (CAWASA) to include RWH as a component of their certification programme;
  - Relevant to small water supply systems, exists already. Apply alternative certification process
- Build capacity within relevant Caribbean agencies and develop a skills bank to provide technical assistance in RWH to territories; (use GWP-C platform)
- Development of model RWH applications for the Caribbean based on research and development

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THANK YOU

http://carpha.org/

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