

Perspectives on water and climate change adaptation

Adapting to climate change in water resources and water services in Caribbean and Pacific small island countries



World Water Council
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co-operative programme
on water
and climate



IUCN



International
Water Association

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This Perspective Document is part of a series of 16 papers on «Water and Climate Change Adaptation»

‘Climate change and adaptation’ is a central topic on the 5th World Water Forum. It is the lead theme for the political and thematic processes, the topic of a High Level Panel session, and a focus in several documents and sessions of the regional processes.

To provide background and depth to the political process, thematic sessions and the regions, and to ensure that viewpoints of a variety of stakeholders are shared, dozens of experts were invited on a voluntary basis to provide their perspective on critical issues relating to climate change and water in the form of a Perspective Document.

Led by a consortium comprising the Co-operative Programme on Water and Climate (CPWC), the International Water Association (IWA), IUCN and the World Water Council, the initiative resulted in this series comprising 16 perspectives on water, climate change and adaptation.

Participants were invited to contribute perspectives from three categories:

- 1 **Hot spots** – These papers are mainly concerned with specific locations where climate change effects are felt or will be felt within the next years and where urgent action is needed within the water sector. The hotspots selected are: Mountains (number 1), Small islands (3), Arid regions (9) and ‘Deltas and coastal cities’ (13).
- 2 **Sub-sectoral perspectives** – Specific papers were prepared from a water-user perspective taking into account the impacts on the sub-sector and describing how the sub-sector can deal with the issues. The sectors selected are: Environment (2), Food (5), ‘Water supply and sanitation: the urban poor’ (7), Business (8), Water industry (10), Energy (12) and ‘Water supply and sanitation’ (14).
- 3 **Enabling mechanisms** – These documents provide an overview of enabling mechanisms that make adaptation possible. The mechanisms selected are: Planning (4), Governance (6), Finance (11), Engineering (15) and ‘Integrated Water Resources Management (IWRM) and Strategic Environmental Assessment (SEA)’ (16).

The consortium has performed an interim analysis of all Perspective Documents and has synthesized the initial results in a working paper – presenting an introduction to and summaries of the Perspective Documents and key messages resembling each of the 16 perspectives – which will be presented and discussed during the 5th World Water Forum in Istanbul. The discussions in Istanbul are expected to provide feedback and come up with suggestions for further development of the working paper as well as the Perspective Documents. It is expected that after the Forum all documents will be revised and peer-reviewed before being published.

3 Adapting to climate change in water resources and water services in Caribbean and Pacific small island countries

This document serves as a contribution to the 5th World Water Forum (Istanbul, 2009) from a small island countries' perspective on Topic 1.1 of the Forum: "Adapting to climate change in water resources and water services: understanding the impact of climate change, vulnerability assessment and adaptation measures".

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Adapting to climate change in water resources and water services in Caribbean and Pacific small island countries

Since the 3rd World Water Forum (Kyoto, 2003) the Caribbean and Pacific region have been collaborating as part of the global Dialogue on Water and Climate (DWC) initiative, which works »to improve the capacity in water resources management to cope with the impacts of increasing variability of the world's climate, by establishing a platform through which policymakers and water resources managers have better access to, and make better use of, information generated by climatologists and meteorologists« (www.waterandclimate.org).

Respective dialogues held in each region in preparation for the 3rd World Water Forum resulted in a Joint Programme for Action on Water and Climate (JPfA) which guided the implementation of various coping and adaptation strategies over the past years in Small Island Developing States (SIDS) of the Caribbean and the Pacific (Annex 1).

At the review of the United Nations Barbados Programme of Action for the Sustainable Development of Small Island Developing States (Mauritius, 2005) the Caribbean and Pacific nations reiterated their commitment to SIDS – SIDS cooperation with the Joint Programme for Action for Water and Climate and the international community was invited to support the implementation of the JPfA and broaden it to all Small Island Developing States regions including the Atlantic and Indian Ocean (Annex 2).

The Mauritius strategy highlighted the importance of both water resources and climate change and requested the international community to provide assistance to Small Island Developing States for the implementation of priority actions as submitted to the 3rd World Water Forum Portfolio of Water Actions for small island countries through, amongst others, the Global Environment Facility (GEF), the World Water Assessment Programme (WWAP), the Global Programme of Action (GPA) and the EU 'Water for Life Initiative'.

The results from the Caribbean and Pacific dialogues on water and climate have been documented in the respective synthesis reports.¹ They closely examine the issues to better understand and plan for the impacts of climate change and climate vulnerability on water resources in SIDS, thus providing a

solid background for this perspective document for the 5th World Water Forum.

SOPAC² and CEHI³ as lead coordinating agencies for water and sanitation in respectively the Pacific and Caribbean region have formalized their collaboration through a MOU between both organizations signed at Kyoto and have since been working together on a variety of issues related to integrated water resource management and related adaptation to climate change.

Since Kyoto, SOPAC and CEHI have mobilized funding for the implementation of the 3rd World Water Forum's SIDS portfolio of water actions including: Integrated Water Resources Management; Hydrological Cycle Observing System; water demand management; water quality capacity-building; water governance; regional water partnerships; and inter-SIDS water partnerships.

As coordinator for the Pacific & Oceania sub-region under the Asia Pacific Water Forum, SOPAC facilitated a review of the Pacific Partnership Initiative on Sustainable Water Management⁴ under which the above priority actions were financed in the Pacific and the 3rd progress report of the partnership is guiding the region's contribution to the 5th World Water Forum.

¹ Springer (2002) and Scott et al (2002).

² Pacific Islands Applied Geoscience Commission, www.pacificwater.org.

³ Caribbean Environmental Health Institute, www.cehi.org.lc.

⁴ The 3rd Partnership Steering Committee Meeting, September 2008, Apia, Samoa.



View from Pigeon Island in Saint Lucia (Donna Spencer).

CEHI in turn is coordinating the Caribbean's position at the 5th World Water Forum through the Americas Regional Process leading to the 5th World Water Forum, with the formulation of a position paper prepared with support from the Inter-American Development Bank (IADB) and the World Bank. Additionally, CEHI continues to strengthen its mandate of integrating watershed and coastal areas management (IWCAM) in the Caribbean region under its programme portfolio and, as such, has undertaken many related activities.

This perspective document will:

- 1 provide examples of 'no regrets' approaches, applied in small island countries to cope with current climate variability and adapt to future climate change, at different levels ranging from communities, local administrations and national governments.
- 2 demonstrate the need for a sound knowledge base and information system, as well as a better understanding of the relation between water resources, water and health, and climatic extremes.
- 3 discuss the need for integrated approaches such as offered by integrated water resources management and drinking water safety planning, and how these concepts can mainstream climate adaptation and should be linked to disaster risk reduction and disaster management.
- 4 influence policy and decision-makers of small island countries, and mobilize increased efforts to take funding for adaptation in the water sector up in the broader development finance discussions.

In general the perspective document aims to provide further guidance to the efforts in SIDS regions in coping and adaptation related to water resources management and provision of water services.

The first chapter deals with general water and climate issues in small island countries. Chapter Two examines the coping and adaptation strategies adopted by SIDS and the advances made in implementation and the need to mainstream climate adaptation into water resources management and disaster risk reduction. The final chapter deals with the political will and need for additional financing to the water and sanitation sector.

1 Water and climate in small island countries

Small island countries are no different from other countries in that freshwater is essential to human existence and a major requirement in agricultural and other commercial production systems. However, the ability of the island countries to effectively manage the water sector differs in Small Island Developing States (SIDS), as they are constrained by their small size, isolation, fragility, natural vulnerability, and a limited human, financial and natural resource base.

Increasingly variable rainfall, cyclones / hurricanes, accelerating storm water runoff, floods, droughts, decreasing water quality and increasing demand for water are so significant in many small island countries that they threaten the economic development and the health of their peoples.



Flooding in Fiji's Rewa Delta (Photo by Marc Overmars).

The Intergovernmental Panel on Climate Change (IPCC) continues to report that expected climatic changes will stimulate an increase in extreme weather events that include higher maximum temperatures, increased number of hot days, more intense rainfall over some areas, increased droughts in others, and an increased frequency and severity of tropical cyclones / hurricanes. Although global climate predictions are being made through advanced models the uncertainty over the expected climate changes for small island countries is hampering an adequate response. Low skill levels of climate forecasts are preventing reliable predictions exceeding a period of 3 months. However, the expected increase in climatic extremes should provide sufficient incentives to 'no regrets' approaches dealing with both floods and droughts.

Although the contribution of small island countries to greenhouse gas emissions is globally insignificant and rank amongst the lowest in the world, the islands face arguably the heaviest and most immediate burden of climate change such as sea storm surges and sea level rise affecting the low lying atoll islands in the Pacific and in the Caribbean as well.

Unless something is done soon, the severe water problems across both the Pacific and Caribbean regions will considerably worsen under the influence of climate change. This message was conveyed by several Pacific leaders attending the 1st Asia Pacific



Accessible technology solutions, such as this wetlands filtration system, are being constructed in Saint Lucia as part of an overall approach to managing wastewater in a changing climate. (Photo by Donna Spencer).

Glacial melt, water and SIDS

The impacts of glacial melt on SIDS are predicted to be especially destructive, both in the short and long-term, including changes in water temperature, salinity, and sea level rise. The GEF-Funded Mainstreaming Adaptation to Climate Change (MACC) project highlighted some of these impacts as:

- Beach erosion: As the sea level rises, more of the Caribbean SIDS beaches will be reclaimed by the Atlantic Ocean and Caribbean Sea.
 - Salinisation of soil, aquifers, and estuaries: Sea level rise will bring salt and brackish waters into the soil, aquifers and estuaries, thus threatening drinking water supplies, agriculture, and important coastal ecosystems.
 - Degradation of mangroves, seagrass beds and coral reefs: The degradation would be caused by the salinisation and beach erosion, as mentioned above. Additionally, the sea level rise will translate into a diminished amount of light reaching coral reefs and sea grass beds. The consequence of their destruction is far reaching, including decreased fish stocks that live and feed in and around the reefs; elimination of natural protection from storm surges; decreased tourism activities on the reefs, such as snorkeling, scuba diving, and fishing; and a decrease in valuable biological diversity.
 - Enhanced storm surges: To further complicate the matter of diminished protection from storm surges, as mentioned above, the higher sea level, combined with other climatic changes, will bring about enhanced storm surges, wrecking more havoc on coastal ecosystems and communities than before.
 - Coastal inundation: With over 90% of populations and economic activities located in the coastal zones of Caribbean SIDS, flooding will have a negative impact on economic livelihoods and human life.
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Water Summit⁵ hosted by Japan in December 2007, and shared by high-level delegates at the October 2007 launch of the initiative for the development of a

⁵ Message from Beppu, 1st Asia Pacific Water Summit, December 2007, Beppu.

1.1 Challenges and constraints

The challenges and constraints of sustainable water resources management in Pacific and Caribbean island countries and territories were categorized into three broad thematic areas at the regional consultation on Water in Small Island Countries held in preparation for the 3rd World Water Forum in Kyoto 2003 . These are:

- 1 Pacific and Caribbean island countries and territories have uniquely fragile water resources due to their small size, lack of natural storage. Competing land use and vulnerability to natural and anthropogenic hazards, including drought, cyclones and urban pollution. This requires detailed water resources monitoring and management and improving collaboration with meteorological forecasting services;
- 2 Water service providers face challenging constraints to sustaining water and wastewater provision due to the lack of both human and financial resource bases, which restrict the availability of experienced staff and investment, and effectiveness of cost recovery. Future action is required in human resources development, water demand management and improving cost recovery;
- 3 Water governance is highly complex due to the specific socio-political and cultural structures relating to traditional community, tribal and inter-island practices, rights and interests. These are all interwoven with past colonial and 'modern' practices and instruments. These require programmes to develop awareness, advocacy, and political will at all levels to create a framework for integrated water resources management.



Water Utilities in SIDS, such as these technicians from St. Kitts, are working to address increasing demand and the challenges of climate change. (Photo by Halla Sahley)

1.2 Joint programme for action on water & climate

In March 2003, ADB and SOPAC facilitated the Water in Small Island Countries sessions at the 3rd World Water Forum. The global SIDS position that resulted from these sessions was mainly the result of the Dialogue on Water & Climate (DWC) session which linked the Pacific and Caribbean regions together on water and climate issues.

The close collaboration between the Caribbean and Pacific regions during preparatory work for the 3rd World Water Forum resulted in the formation of the Joint Caribbean-Pacific Programme for Action on Water & Climate (JPfA).

The JPfA comprises 22 action elements, common to both the Pacific and Caribbean regional consultation outcomes, covering four collaborative areas: research, advocacy and awareness, capacity-building and governance. From this immediate priority, actions were identified in six areas. The JPfA takes an Integrated Water Resources Management approach to addressing water and climate issues in SIDS, as demonstrated by the Integrating Watershed and Coastal Area Management (IWCAM) in the Caribbean, under CEHI and now accompanied by the Pacific Sustainable Integrated Water Resources and Wastewater Management Programme (Pacific IWRM) under SOPAC. The JPfA promotes the transfer of knowledge, expertise, positional statements and personnel between the two regions to the benefit of the 34 countries involved.



Raised limestone island of Nauru which is depending on rain-water harvesting and desalination. (Photo by Marc Overmars)

At the 3rd World Water Forum global SIDS agreed to six priority actions, referred to as the Small Island Countries Portfolio of Water Actions namely:

- Water resources management through the Hydrological Cycle Observing System (HYCOS);
- Water demand management programme;
- Drinking water quality monitoring;
- Improving water governance;
- Regional Type II Water Partnership support;
- Interregional SIDS water partnership support through the JPfA.

2 Vulnerability and adaptation assessments

As reported in the Pacific Synthesis Report on Water and Climate (Scott et al, 2002) vulnerability and adaptation assessments in relation to climate change are required of signatory countries to the United Nations Framework Convention on Climate Change (UNFCCC). The Pacific Islands Climate Change Assistance Programme (PICCAP) was developed to assist with the reporting, training and capacity-building required under the Convention. Climate Change Country Teams established under PICCAP undertook to:

- prepare inventories of greenhouse gas sources and sinks;
- identify and evaluate emission reduction strategies;
- assess vulnerability to climate change;
- develop adaptation options;

- develop a national implementation strategy for mitigating and adapting to climate change in the long term.

In a synthesis of Pacific preliminary national vulnerability assessments, Hay and Sem (2000) note the following adaptations with relevance to water resources, which are also applicable to Caribbean SIDS:

- Improved management and maintenance of existing water supply systems has been identified as a high priority response, due to the relatively low costs associated with reducing system losses and improving water quality;
- Centralized water treatment to improve water quality is considered viable for most urban centres, but at the village level it is argued that more cost-effective measures need to be developed;
- User-pay systems may have to be more widespread;
- Catchment protection and conservation are also considered to be relatively low cost measures that would help ensure that supplies are maintained during adverse conditions. Such measures would have wider environmental benefits, such as reduced erosion and soil loss and maintenance of biodiversity and land productivity.
- Drought and flood preparedness strategies should be developed, as appropriate, including identification of responsibilities for pre-defined actions;
- While increasing water storage capacity through the increased use of water tanks and/or the construction of small-scale dams is acknowledged to be expensive, the added security in the supply of water may well justify such expenditure;



Jamaicans crossing the Hope River following flooding from Hurricane Gustav. (Photo by Franklin McDonald)



Poor, unregulated settlements on the river's edge in Haiti are highly prone to flooding. (Photo by Vincent Sweeney)

- Development of runways and other impermeable surfaces such as water catchments is seen as possible, but an extreme measure in most instances. Priority should be given to collecting water from the roofs of buildings;
- Measures to protect groundwater resources need to be evaluated and adopted, including those that limit pollution and the potential for saltwater intrusion;
- The limited groundwater resources that are as yet unutilized in the outer islands of many countries could be investigated and, where appropriate, measures implemented for their protection, enhancement and sustainable use;
- The development of desalination facilities is considered to be an option for supplementing water supplies during times of drought, but in most instances the high costs are seen as preventing this being considered as a widespread adaptation option.

Amongst the many assessment findings summarized by Hay (2000) the following are most relevant to water and climate:

- climate variability, development, social change and the rapid population growth being experienced by most small island countries are already placing pressure on sensitive environmental and human systems, and these impacts would be exacerbated if the anticipated changes in climate and sea level (including extreme events) did materialize;
- land use changes, including settlement and use of marginal lands for agriculture, are decreasing the natural resilience of environmental systems and

hence their ability to accommodate the added stresses arising from changes in climate and sea level;

- given the limited area and low elevation of the inhabitable lands, the most direct and severe effects of climate and sea level changes will be increasing risks of coastal erosion, flooding and inundation; these effects are exacerbated by the combination of seasonal storms, high tides and storm surges;
- other direct consequences of anticipated climate and sea level changes will likely include: reduction in subsistence and commercial agricultural production of such crops as taro, bananas and coconut; decreased security of potable and other water supplies; increased risk of dengue fever, malaria, cholera and diarrhoeal diseases; and decreased human comfort, especially in houses constructed in western style and materials (especially in the Pacific);
- groundwater resources of the lowlands of high islands and atolls may be affected by flooding and inundation from sea level rise; water catchments of smaller, low-lying islands will be at risk from any changes in frequency of extreme events;
- the overall impact of changes in climate and sea level will likely be cumulative and determined by the interactions and synergies between the stresses and their effects; and
- the current lack of detailed regional and national information on climate and sea level changes, including changes in variability and extremes have resulted in most assessments being limited to using current knowledge to answer 'what if' questions regarding environmental and human responses to possible stresses.

The first of these findings is particularly significant since it implies that, in most parts of the Pacific and Caribbean regions, present problems resulting from increasing demand for water and increasing pollution of water may be much more significant than the anticipated affects of climate change.

The final finding is also significant in that it refers to climate variability. In reporting obligations, The UNFCCC referred specifically to climate change (rather than to climate variability and change), possibly reflecting the perspective of climate change science existing at the time the Convention was drafted. A greater appreciation of the role of variability has developed and it is now generally recognized

that the impacts of climate change are likely to be experienced through changes in variability. These considerations suggest that managing water resources for variability and extremes is fundamental to the issue of adapting to climate change in the longer term.

That conclusion is also supported by the vulnerability and adaptation assessments completed for Fiji and Kiribati (World Bank, 2000) which provide examples of climate change impacts on water resources in high and low islands and reach the conclusions that:

- Pacific Island countries are already experiencing severe impacts from climate events;
- island vulnerability to climate events is growing independently of climate change;
- climate change is likely to impose major incremental social and economic costs on Pacific Island countries; and
- acting now to reduce present day vulnerability could go a long way toward diminishing the effects of future climate change.

In the Caribbean region the impacts of rising temperatures are being linked to the recent and very active hurricane seasons which have spawned several

intense hurricanes resulting in billions of dollars in damage and thousands of deaths caused mainly by flooding. Of the Caribbean countries, Haiti has suffered the extreme consequences on account of the severe degradation of its forests with great loss to life and property.

Some key recommendations derived from these conclusions include:

- the adoption of a ‘no regrets’ adaptation policy;
- development of a broad consultative process for implementing adaptation;
- require adaptation screening for major development projects;
- strengthen socio-economic analysis of adaptation options.

These recommendations reflect the need for the mainstreaming of climate change adaptation policies into water resources management.

The guidebook on ‘Surviving Climate Change in Small Islands’ provides an overview for the assessment of vulnerability of water resources to climate changes (Emma L. Tompkins et al, 2005).

Table 1: Assessment of vulnerability.

Climate change	Exposure	Who or what affected
Sea level rise and saltwater intrusion	Salinisation of water lenses Less fresh water available	Human consumption and health Water suppliers Plant nurseries and parks Biodiversity, protected areas
Reduced average rainfall	Less fresh water available Droughts	Aquifer recharge rates Cisterns and reservoirs Biodiversity
Increased evaporation rates	Soil erosion	Farming community; crop yields Biodiversity
Increased rainfall intensity	Runoff and soil erosion	Reduction in crop production Sedimentation of water bodies Blocked storm water wells

Adapted from: Hurlston (2004).

The table above shows that climate change is likely to increase the exposure of small islands to water shortages for various reasons. Specific groups are likely to be sensitive, for example, those who rely on subsistence agricultural production and families who rely

on cisterns may have to consider other means of accessing water.

3 Coping and adaptation

The Global Water Partnership states in their latest policy brief that the best approach to manage the impact of climate change on water is that guided by the philosophy and methodology of Integrated Water Resources Management (GWP, 2007). It also states that the best way for countries to build the capacity to adapt to climate change will be to improve their ability to cope with today's climate variability.

For small islands, climate change is just one of many serious challenges with which they are confronted. Adaptation to climate change impacts certainly requires integration of appropriate risk reduction strategies within other sectoral policy initiatives such as in water resources management (Emma L. Tompkins et al, 2005).

In the Pacific region, concentration on the potential impacts of climate change on small island communities has even deflected attention and resources away from the immediate and serious day-to-day problems faced by small island nations, particularly in water resources (White I. et al, 2007). The above obviously does not preclude the application of coping strategies and adaptation measures to climate variability and change, which, on the contrary, is essential for the sustainable management of water resources in small island countries and territories.

Regarding the vulnerability of small island countries and territories to climate variability and change as well as anthropogenic influences, the required coping and adaptation strategies have been articulated under a specific theme of 'Island Vulnerability' in the Pacific Regional Action Plan on Sustainable Water Management (SOPAC, 2002) as follows:



Raised limestone island of Niue also known as the 'Rock of Polynesia'. (Photo by Marc Overmars)



Many islanders rely on coastal resources. (Photo by Marc Overmars)

- **Key Message 1:** Strengthen the capacity of small island countries to conduct water resources assessment and monitoring as a key component of sustainable water resources management.
- **Key Message 2:** There is a need for capacity development to enhance the application of climate information to cope with climate variability and change.
- **Key Message 3:** Change the paradigm for dealing with Island Vulnerability from disaster response to hazard assessment and risk management, particularly in Integrated Water Resource Management (IWRM).

Actions have been undertaken to address each of the key messages not only in the Pacific but also in other SIDS regions.

3.1 Water resources monitoring and assessment

There is a need to invest in adequate water resources monitoring and assessments in order to cope with climatic extremes, both droughts (often related to ENSO events) and flooding (often linked to the occurrence of cyclones/hurricanes).

Insufficient understanding and knowledge on how rivers respond to extreme rainfall or how resilient aquifers are in prolonged periods of drought will compromise the provision of freshwater supplies. This requires the increased capacity of National Hydrological Services in flood and drought forecasting as well as a stronger collaboration between them, water resources managers and water utilities.

Awareness of the effects of floods and droughts on drinking water quality needs to be increased through closer engagement between water users and water suppliers. Increased health surveillance and water quality monitoring should be encouraged especially in times of disasters.

As examples, the Pacific and Caribbean Hydrological Cycle Observing Systems are now being established through support from the European Union Water Facility and the French Government respectively. Water quality monitoring is being supported through NZAID in the Pacific, and the Institut de recherche pour le développement (France), the Caribbean Environmental Health Institute and the Caribbean Institute for Meteorology and Hydrology in the Caribbean region.

The Pacific HYCOS programme is providing support to National Hydrological Services in the region and is building their capacity in flood and drought forecasting as well as in basic monitoring of water resources. This information is essential for any climate adaptation initiative whether they focus on domestic (water supply), agricultural (irrigation) or industrial (hydropower) use of water. The need for thorough analysis of hydro(geo)logical information and water quality, as well as water quantity data, is frequently overlooked by adaptation programmes which sometimes make assumptions on the impacts of climate on water resources without adequate research. If we do not know how aquifers respond to droughts or how rivers respond to floods it will be impossible to make sensible decisions on adaptation measures which are aiming to deal with the increase of climatic extremes.

The Carib-HYCOS project seeks to enhance natural disaster mitigation capabilities by the use of modern flood forecasting and warning systems; strengthen water management capabilities by improving the knowledge base of water resources concerning quantity, quality and use; increase exchange of information and experience, particularly during natural disasters; and develop technological capabilities (including training and technology transfer) appropriate to the circumstances and realities of each country. It is expected that the project implementation will result in: (a) better understanding of the regional hydrological phenomena and trends in order to rationalize the use of water resources; (b) modernization of the region's water



Water resources on atoll islands like South Tarawa in Kiribati are being affected by climate variability and change. (Photo by Marc Overmars)

resources agencies and their response capability to extreme phenomena; (c) integration of these agencies into the region's development decision-making; and (d) improved cooperation among the region's national water agencies, including the real-time circulation of water and environment data.



Water Quality Monitoring in Dominica. (Photo by Sasha Beth Gottlieb)



Hydrological monitoring, such as on the island of Espirito Santo, Vanuatu, is essential for water resources management in small island countries. (Photo by Marc Overmars)

3.2 Using climate information

There is a need to make use of climate forecasts to support decision-makers in the water sector. Research into the interaction of the ocean and atmosphere over the last two decades has resulted in an impressive ability to observe and account for many of the factors governing climatic variability at the seasonal and inter-annual time scale.

National Meteorological Services are being strengthened in their capacity to develop techniques that are able to produce climate forecasts of modest skill, but this information is not easily accessible and available for interpretation by water resources and water supply managers. Particularly for the rainfall dependent low lying atoll islands, strategies to cope with extended periods of drought will largely depend on their ability to make interpretations of three-monthly rainfall forecasts.

Strategic storage of rainwater and the introduction of water saving or water conservation measures

adopted by both the utility and the general public, will enhance the ability of Pacific and Caribbean island countries and territories to overcome droughts and maintain sufficient standards of drinking water quality.

The Pacific Island Climate Update (ICU) supported by NZAID provides such information to end-users in the Pacific in a regional overview, whereas the strengthening of NMSs is being undertaken under an AusAID-funded climate prediction programme. Both are linked to climate centres in the Pacific islands, the United States, France, Australia and New Zealand.

In the Caribbean, a joint collaboration between the Caribbean Community Climate Change Centre (CCCCC), the Caribbean Institute for Meteorology and Hydrology (CIMH) and the Brace Center for Water Resources Management of McGill University will see the development of a Caribbean Drought and Precipitation Monitoring Network for the region that will be hosted at the CIMH.

Through the analyses of rainfall data and use of GIS in Tuvalu, under the Pacific HYCOS programme, support is provided to an AusAID and EU-funded initiative, Vulnerability and Adaptation, to provide all households on the main atoll of Funafuti with a rainwater harvesting tank in order to provide a strategic water storage to overcome extended periods of droughts which are often linked to ENSO episodes. The UNEP, through CEHI, is supporting similar efforts in Caribbean SIDS by using GIS-assisted mapping methods of rainfall capture potential and water availability to promote the practice of rainwater harvesting in water stressed parts of the region.



Outer islands in the Pacific are depending on increasingly variable rainfall (Photo by Marc Overmars)



Rainwater harvesting such as on Banaba, Kiribati (l) and Mabouya Valley, Saint Lucia (r) has been under utilised in many small island countries. (Photos by Marc Overmars and Donna Spencer)

3.3 Mainstreaming risk management

There is a need to mainstream risk management into water supply and water resources management, building on the integrated approaches adopted by Pacific and Caribbean island countries and territories such as Drinking Water Safety Planning (DWSP) and Integrated Water Resources Management.

Drinking Water Safety Planning is defined as “a comprehensive risk assessment and risk management approach that encompasses all steps in the water supply from ‘catchment to consumer’ to consistently ensure the safety of water supplies” (WHO, 2004). It addresses all aspects of drinking water supply through an integrated approach focusing on the control of abstraction, treatment and delivery of drinking water in combination with attention for awareness and behaviour change.

This requires close collaboration between the water supplier, the water quality and health regulator and the water resources managers in conjunction with a strong participation of communities living in catchments of high volcanic islands, on top of water



Pollution of vulnerable groundwater lenses are a major concern for many small island countries. (Photo by Marc Overmars)

reserves, low lying atolls or raised limestone islands. Improved hygiene behaviour and awareness of the linkages between drinking water and health are essential, and participatory approaches and community-based monitoring are needed for urban as well as rural communities.

The introduction of DWSP is promoted in the Pacific through an AusAID-funded programme by SOPAC in collaboration with WHO, whereas the U.S. Centers for Disease Control and Prevention (CDC) is promoting this new concept together with CEHI in the Caribbean.



Children are particularly vulnerable to the adverse impacts of climate change, felt in the lower reaches of watersheds, such as the Haina Watershed in the Dominican Republic. (Photo by Donna Spencer)

An example of an appropriate adaptation strategy for water is provided by Tonga where the nationally-developed Drinking Water Safety Plan by the Tonga Water Board and the Ministry of Health guided the scoping of an EU-funded drought resilience building project valued at 1.1 million euros focused on risk prevention instead of response. In the Caribbean, the Spanish Town water supply system in Jamaica was the first pilot of a DWSP approach through the joint collaboration between the local National Water Commission and the CDC. The approach is presently being replicated in Guyana (part of the Caribbean yet on the South American mainland), again in partnership with the CDC and CEHI. The collective experiences of both countries will be applied when introducing the process to the other Caribbean SIDS.

The concept and the approaches which IWRM embodies - namely, the need to take a holistic approach to ensure the socio-cultural, technical, economic and environmental factors are taken into

account in the development and management of water resources - has been practiced at a traditional level for centuries in some islands.

For small island countries and territories these IWRM plans would need to include drought and disaster preparedness plans. Pollution on land from inadequate wastewater disposal, increased sediment erosion and industrial discharges are impacting upon coastal water quality and fisheries stock which sustain entire island populations. This requires small island countries and territories to look at managing water resources not only within the watershed but also the receiving coastal waters.

The introduction of IWRM in SIDS is being promoted through the GEF-IWCAM Programme by CEHI and the Pacific IWRM Programme by SOPAC under the Global Environment Facility and EU Water Facility.

Through close alignment of climate adaptation programmes also funded through the GEF in the Caribbean (CPACC, MACC, and SPACC) and the Pacific (PACC) the opportunity arises to ensure that flood and drought management is being addressed in the countries concerned within an IWRM framework. Use can be made of the established APEX bodies that can function as National Water and Climate Committees and steering committees for both adaptation and integration of water resources management.

At present there is still a disconnect between risk management, climate adaptation and water resources management with receiving small island countries, donors and supporting agencies working in different silos foregoing the principles of mainstreaming in ongoing natural resources management processes.

This needs to be changed through interventions at the highest levels such as through the Prime Minister's Office, Ministries of Planning or Finance and guided by a sound information base on water and climate.

4 Political will and financing

It is generally recognized that improving the way we use and manage our water today will make it easier to address the challenges of tomorrow. With respect to climate change it is evident that SIDS will have to deal with the current challenges and constraints

including climate variability before they can adapt to future climate changes.

A recent WHO/SOPAC report revealed that the annual incidence of diarrhoeal diseases in the Pacific still nearly matches the numbers of its inhabitants with 6.7 million cases of acute diarrhoea each year, responsible for the annual death of 2,800 people, most of them children less than 5 years old. Country statistics on access to improved sanitation and improved drinking water indicate that on average approximately only half of the total population of the Pacific island countries are served with any form of improved sanitation or drinking water (WHO/SOPAC, 2008).



Providing safe drinking water to communities is posing increasing challenges to small island countries. (Photo by Marc Overmars)

In the Caribbean, flood events associated with successive tropical storms and hurricanes in recent years have prompted stepped-up surveillance and monitoring by national public health agencies in terms of control of outbreaks of dengue fever and diarrhoeal diseases. Although in most countries of the Caribbean access to potable drinking water is upwards of 80% (with the exception of Haiti), interruptions to water supply following storms is a significant risk factor in terms of maintaining health and sanitation.

The 1st Asia-Pacific Water Summit held in December 2007 in Beppu, Japan, was attended by six Pacific Island Leaders from the Federated States of Micronesia, Palau, Tuvalu, Nauru, Niue and Kiribati, as well as Ministers from Fiji, the Cook Islands and Papua New Guinea. SOPAC, as focal point for the Oceania component of the Asia-Pacific Water Forum, provided support to countries participating in the

Summit and facilitated a special session on water and climate in small island countries.

The large participation by Pacific Heads of State at this Summit was a testament of their strong political commitment to meeting future water challenges and their efforts to cope with an increasingly variable climate, and adapt to the future effects of global climate change.

The Pacific leaders attending the summit in Beppu reaffirmed their commitment to give the highest priority to water and sanitation in economic and development plans; improve governance, efficiency, transparency and equity in all aspects related to the management of water, particularly as it impacts on poor communities; take urgent and effective action to prevent and reduce the risks of flood, drought and other water-related disasters; and support the region's vulnerable small island states in their efforts to protect lives and livelihoods from the impacts of climate change (APWF, 2007).

The Summit specifically raised attention to the opportunity that presents itself at this moment: to mainstream Climate Adaptation, Disaster Risk Reduction and Water Safety Planning into Integrated Water Resources Management.

The commitment shown at Beppu still needs to be converted into action but signs of countries linking national priorities such as improving access to safe drinking water and sanitation to climate adaptation efforts and risk reduction are promising, such as in Tuvalu, Kiribati, Tonga, the Marshall Islands and Nauru.

Commitments from donors to increase funding for both climate adaptation and water and sanitation are promising as demonstrated by AusAID, EU, GEF, World Bank and other donor agencies. Rather than implementing 'quick fixes' focused on infrastructural improvements, adequate attention should be paid to the building of local capacity to improve the management of water services and resources in order to achieve a degree of sustainability of interventions.

Climate change issues are addressed at the regional level by the Council for Trade and Economic (COTED) of the Caribbean Community (CARICOM). Additionally, Caribbean Heads of Government have included climate change as a specific item on the agenda of their meetings. Currently, the Prime Minister of Saint Lucia has the responsibility within the CARICOM Cabinet for climate change and sustainable development issues. At the last Caribbean



Improving access to water and sanitation requires political will
(Photo by Marc Overmars)

Heads of Government meeting (July 2008), a Regional Task Force on Climate Change was established to provide technical advice to participants, specifically focusing on COPS negotiations.

Combined with adequate priority given to water and sanitation in national development plans and strategies, these actions will provide the best approaches to achieve the MDG target of halving the proportion of people without access to safe drinking water and basic sanitation by 2015 and to be prepared for the future. Harmonization of donor agency programmes are in this respect key to maximizing the impact of actions, and this would need to be supported by a regional framework for monitoring investments and results.

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Annex 1

JOINT CARIBBEAN AND PACIFIC PROGRAMME FOR ACTION ON WATER AND CLIMATE

A. RESEARCH (11 Action Elements)

- 1) Strengthen the application of climate information and strengthen the links between meteorological and hydrological services;
- 2) Strengthen institutional capacity for data generation;
- 3) Develop rainfall and drought prediction schemes based on existing models;
- 4) Enable regional support to develop water application of climate information and prediction;
- 5) Implement a programme of climate analysis for assessment of extreme weather events; develop minimum standards for risk assessments;
- 6) Implement actions to strengthen national capacity (equipment, training, etc.) using the model outlined in the Pacific Hydrological Cycle Observation System (HYCOS) proposal and recommendations regarding water quality;
- 7) Implement a programme of targeted applied research projects to address knowledge gaps in line with recommendations and priorities presented;
- 8) Develop and/or implement minimum standards for conducting island water resources assessment and monitoring;
- 9) Implement appropriate water quality testing capability and associated training at local, national and regional levels;
- 10) Strengthen and enhance communication and information exchange between national agencies involved with meteorological, hydrological and water quality data collection programmes (including water supply agencies and health departments);
- 11) Utilize the research capabilities at regional science institutions;

B. PUBLIC EDUCATION, AWARENESS AND OUTREACH (4 Action Elements)

- 1) Provide high level briefings on the value of hazard assessment and risk management tools;
- 2) Support community participation in appropriate water quality testing programmes targeted at environmental education and awareness of communities, using existing and proposed programmes as models;
- 3) Recognize the value of informal community groups;
- 4) Include the media as a specific institution.

C. EDUCATION AND TRAINING (2 Action Elements)

- 1) Enhance education and career development opportunities in the water sector;
- 2) Implement hydrological training for technicians in line with the recommendations presented in a proposal to meet training needs;

D. POLICY AND INSTITUTIONAL DEVELOPMENT (5 Action Elements)

- 1) Build environment to facilitate the emergence of an IWRM framework;
- 2) Incorporate the community in policy development at the ground level;
- 3) Build capacity in the use of a risk management approach to integrated resource management, in EIAs;
- 4) Develop appropriate policy/legislative instruments;
- 5) Harmonize legislation, regulations and policy.

Annex 2

Mauritius Strategy for the Further Implementation of the Programme of Action for the Sustainable Development of Small Island Developing States

Port Louis, Mauritius, 15 January 2005

V. Freshwater resources

27. Small Island Developing States continue to face water management and water access challenges, caused in part by deficiencies in water availability, water catchment and storage, pollution of water resources, saline intrusion (which may be exacerbated, *inter alia*, by sea-level rise, unsustainable management of water resources, and climate variability and climate change) and leakage in the delivery system. Sustained urban water supply and sanitation systems are constrained by a lack of human, institutional and financial resources. The access to safe drinking water, the provision of sanitation and the promotion of hygiene are the foundations of human dignity, public health and economic and social development and are among the priorities for Small Island Developing States.

28. Small Island Developing States in the Caribbean and the Pacific regions have demonstrated their commitment to SIDS – SIDS cooperation with the Joint Programme for Action for Water and Climate. The international community is invited to support the implementation of this programme, and the proposal to broaden it to all Small Island Developing States regions.

29. Further action is required by Small Island Developing States, with the necessary support from the international community, to meet the Millennium Development Goals and World Summit on Sustainable Development 2015 targets on sustainable access to safe drinking water and sanitation, hygiene, and the production of integrated water resources management and efficiency plans by 2005.

30. The international community is requested to provide assistance to Small Island Developing States for capacity-building for the development and further implementation of freshwater and sanitation programmes, and the promotion of integrated water resources management, including through the Global Environment Facility focal areas, where appropriate, the World Water Assessment Programme, and through support to the Global Programme of Action Coordination Office and the EU “Water for Life Initiative”.

31. The Fourth World Water Forum, to be held in Mexico City in March 2006, and its preparatory process will be an opportunity for the Small Island Developing States to continue to seek international support to build self-reliance and implement their agreed priority actions as submitted to the Third World Water Forum Portfolio of Water Action, namely: integrated water resources management (including using the Hydrological Cycle Observing System); water demand management; water quality capacity-building; water governance; regional water partnerships; and inter-small island developing State water partnerships.