POLICY BRIEF

CLIMATE CHANGE AND WATER AVAILABILITY IN THE CARIBBEAN

Framing the Issue

Agriculture-a climate dependent sector- is a major pillar for economic and social development in many Caricom countries, accounting for approximately 7 % of trade within Member States in 2007, and more than 10% of employment in Guyana, Suriname and the OECS. Importantly, in Guyana agriculture contributes more than 30% to export earnings (Bynoe, 2010).

Regrettably, these socio-economic contributions by this sector can easily be reversed by **global climate change.** It is important to note that climate change is already severely impacting the hydrological cycle with consequential effects on human development and security, given that availability and quality of water determine ecosystem productivity, both for agricultural and natural systems; hence the need for Caribbean policy makers to be greatly concerned.

According to the Intergovernmental Panel on Climate Change Fourth Assessment Report (2007) '*water and its availability and quality, will be the main pressures on, and issues for, societies and the environment under climate change; and that people will feel the impact of climate change most strongly through changes in the distribution of water around the world and its seasonal and annual variability*.

Flood irrigation in Trinidad

Decreased water availability will more than likely be a feature of the future Caribbean region in the future. Global Circulation Models (GCM) indicate that the Caribbean is expected to be between 1 and 5 degrees warmer by the end of the century[1]. Taylor, et al (2011) predict that the Caribbean will become significantly drier under climate change, up to 30% drier in the annual mean, and that **drying will be most significant between May and November, when the region is normally at its wettest.** This could significantly reduce available water by reducing both surface flows and water available for groundwater recharge. Moreover, declines in precipitation could increase the risk of periods of drought for the Caribbean region. Drought may become more frequent, as well as more severe. **Countries (**including Dominica,

[1] Recent studies suggest that the Caribbean has also recorded a warming trend of approximately 0.6 degrees Celsius since the 1960s or 0.12-0.14 degrees Celsius per decade (McSweeney et al. 2008).

Grenada, St. Kitts and Nevis, St. Lucia and St. Vincent and the Grenadines (St. Vincent Island), **which rely mainly on surface water rather than aquifers may be the most vulnerable to declining precipitation levels since surface water generally responds more rapidly to drought conditions than aquifers.**

Additionally, increased rainfall intensity and storm activity may lead to increased sediment and pollutant transport into both surface and groundwater systems, particularly in a karst environment (Farrell et al. 2007, Cashman et al. 2010). Simpson et al. (2009) highlight that there are several reported cases where hurricanes have led to a reduction in water resource availability in some Caribbean countries. Further, in Antigua and Barbuda, extreme rainfall from hurricanes has caused the loss of topsoil and has eroded gullies, which in turn has led to increased surface runoff (from even normal rainfall) and subsequent reductions in groundwater recharge.

All of these climate change related issues have dire consequences for agriculture and food security in the Caribbean region.

Climate Change Consequences for the Agricultural Sector

For agriculture in the Caribbean rainfall is KING.

In the agricultural sector, both below average and average rainfall have consequences for agricultural productivity. In Jamaica, to adapt to drought conditions farmers have estimated the onset of the drought season and have resorted to increased use of short-maturing crops. This has two negative outcomes; reduced overall crop output and reduced income generated during a season (Gamble et al., 2010). The dependence on rainwater for irrigation also has its implications during drought conditions. Moreover, salt water intrusion will affect ground water wells that farmers depend on, also resulting in reduction in crop yields. Overall reduction in food output will impact on the Region's food security and result in greater imports which require expenditure that could be re-directed into the labour market. It should be noted that the Caribbean Region is already in a deficit, paying over USD$ 3.5 billion annually to import food.

Increased intensity in rainfall, melting glacial ice and large-scale deforestation is already increasing soil erosion and depriving the topsoil of nutrients. Changes to the proper functioning of ecosystems will increase the loss of biodiversity and damage ecosystem services.

Climate change will directly affect the demand for water; for instance, changes in demands will derive from industrial and household use, or from irrigation. **Water demand** for irrigation may increase as transpiration increases owing to higher temperatures. Depending on future trends in water use efficiency and the development of new power plants, the demand for water in thermal energy generation could either increase or decrease.

Increased precipitation can cause flooding, and subsequent water logging of roots and crop death. Other indirect effects of floods include the spread of pests such as rodents that attack certain crops such as root crops for example in Grenada (Thomas, 2011). Reduced rainfall results in drought conditions that decreases soil moisture and can result in a loss of crops. The region is already dealing with fluctuations in water resources due to climate variability, as indicate **in the table below**.

Country	Date	Impact of Drought
Guyana	2009-2010	Up to 35% of rice fields left uncultivated. US1.3 million spent to operate irrigation pumps (US16, 000/day). About 150 acres irrigated with salt water in desperation. In 2010 alone over 100, 000 acres experienced water stress prompting government investment of over USD30 million
Trinidad	Jan-May 1987	Over 10,000 acres of natural forest burned resulting in severe crop losses at mean of US500,000/year
Dominica	2010	Banana export fell 43% below normal
St. Vincent & Grenadines	2010	Crop production reduced to 20% of normal
Antigua and Barbuda	2010	Loss of 25% of onion crop, 30% of tomato crop estimated at 250,000 kg
Jamaica	1996 and 1998 1999-2000	Severe loss of sugar crop, caused government US100 million in compensation Rainfall fell to 255 of mean resulting in crop losses of over US6million.

Source: Taylor et al (2011)

With climate change, some of the already water stressed islands of the Caribbean may continue to experience higher water demand than there is supply to satisfy it. This may be an exacerbation of what is already evident in the dry season in some territories, during which available water can be reduced by up to 40% (Cashman et al. 2010).

On the other hand, floods account for approximately 70 % of all weather-related losses in the region's agriculture sector. For example, in Guyana, the 2005 resulted in US$ 55 million in damage to the agriculture sector, while the 2006 floods resulted in total losses to the sector of US$ 22.5 million. In both cases, Guyana's economic and social development process was severely hindered at the national and local levels.

Unarguably, these consequences strongly suggest that "Business as Usual or Inaction" is not wise policy options for the Regions.

Moving Forward

In an effort to tackle longer term implications of climate change, Caricom countries should build on the strategies already in place to deal with shorter term fluctuations in water resources. For example, in order to meet the rising needs for water, alternative routes have already been instituted

in many countries. Among them is desalination, which has become a dominant means of water supply in countries like Barbados (Cashman et al. 2010). While this method offers a renewable supply of water to meet growing demands, it also has high economic, environmental and energy costs (Cooley et al. 2006). Rainwater harvesting is also being utilized, particularly for residences on smaller islands and for agriculture (Vörösmarty et al. 2005, Cashman et al. 2010).

Water scarcity and water insecurity demand new perspectives and new solutions; thus, other policy interventions could include:

- Promote, develop and implement Integrated Water Resource Management Plans[2] (IWRM) in each Caricom member state.
- Improve information systems and flood and drought early warning systems to provide land and water users with timely and adequate information and knowledge about availability and suitability of resources to promote sustainable agriculture and prevent further environmental degradation. Information exchange and dialogue between the agriculture, water and climate communities is vital (FAO, 2008c), not only at national levels.
- Promote and encourage rainwater harvesting as an opportunity to enhance ecosystem productivity, thereby improving livelihoods, human well-being and economies.
- Develop human resource, capacity and skills of policy makers and end-users to help them deal with new challenges.
- Promote efficient irrigation and drainage systems to increase water productivity, while also making better use of groundwater storage to enhance water availability.
- Diversify the agricultural base within member states.
- Adopt varieties and species of crops with increased resistance to heat stress, shock and drought. Adoption of water-efficient technologies to 'harvest' water, conserve soil moisture (e.g. crop residue retention, zero-tillage), and reduce siltation and saltwater intrusion.
- Improved water management to prevent water logging, erosion and nutrient leaching.
- Modify crop calendars, i.e., timing or location of cropping activities.
- Promote, encourage and scale up crop insurance.
- Improve watershed management, integrating the different natural resources – water, soil, flora and fauna through the promotion of Integrated Water Resources Management (IWRM) processes.
- Develop regional databases on land-use statistics (crop production, area harvested and yields) at sub-national level to facilitate modelling of climate change impacts on the current centres of food production and subsequent changes in land use (agricultural production) systems.
- Modify existing physical infrastructure and construct new ones to better manage water supply systems.
- Promote conservation and improved efficiency.
- Improve research, particularly in the area of biotechnology.
- Adopt a new approach governed by the statement: Grow more food with less water and less negative impact on fragile resources.

[2] . IWRM is a structured process that addresses the need to bring together those who use water and those who impact on it to work together to solve their water challenges. Integrated water resources management offers a systematic way to build and nurture these linkages and seeks to reconcile Social Equity, Economic Efficiency and Environmental Sustainability.

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