

# WATER MANAGEMENT IN LATIN AMERICA AND THE CARIBBEAN

*Jorge Alejandro Silva Rodríguez de San Miguel*

Economía, Organización y Ciencias Sociales





# **WATER MANAGEMENT IN LATIN AMERICA AND THE CARIBBEAN**

*Jorge Alejandro Silva Rodríguez de San Miguel<sup>1</sup>*

---

<sup>1</sup> Departamento de Territorio y Ambiente, Centro Interdisciplinario de Investigaciones y Estudios sobre Medio Ambiente y Desarrollo (CIEMAD), Instituto Politécnico Nacional (IPN).



Editorial Área de Innovación y Desarrollo, S.L.

Quedan todos los derechos reservados. Esta publicación no puede ser reproducida, distribuida, comunicada públicamente o utilizada, total o parcialmente, sin previa autorización.

© del texto: **Jorge Alejandro Silva Rodríguez de San Miguel**

ÁREA DE INNOVACIÓN Y DESARROLLO, S.L.  
C/ Els Alzamora, 17 - 03802 - ALCOY (ALICANTE) [info@3ciencias.com](mailto:info@3ciencias.com)

Primera edición: **marzo 2018**

ISBN: **978-84-948257-9-8**

DOI: <http://dx.doi.org/10.17993/EcoOrgyCso.2018.35>

## About the author

He holds a PhD in Administrative Sciences from Escuela Superior de Comercio y Administración, Santo Tomás Unit (ESCA-ST), a master's degree in Administration and a bachelor's degree in Industrial Management by Unidad Profesional Interdisciplinaria de Ingeniería y Ciencias Sociales y Administrativas (UPIICSA). All his training was at IPN.

His scientific production includes scientific papers published in national and international indexed journals and participations in national and international congresses. He also has several recognitions and distinctions, highlighting, at the doctoral level, in the branch of Social and Administrative Sciences of IPN, Lázaro Cárdenas Medal given by the president of Mexico in 2015, the award for the best PhD thesis and the award for best performance. In addition, he is a member of the National System of Investigators of Mexico (SNI).

In the field of work, he collaborated in the design of a PhD program in Administration Sciences at ESCA-ST. He worked at IPN's CIEMAD as a Head of Department of Society and Environmental Policy and he currently works in the same institution as a Head of Department of Territory and Environment.

In his academic career, he has taught at the master's and doctoral levels and has participated in different research projects. His main field of work is Administrative Sciences: Public Administration and Business Administration, in particular in the following topics: Integrated Water Resources Management, Public Policies in Environment and Sustainable Companies Management.



# Index

ABSTRACT .....	9
INTRODUCTION .....	11
1. Water Resources in the LAC Region .....	13
2. Regional Situation of Water Management in LAC.....	14
3. Impact of the Water Management Problem in LAC Countries .....	17
4. Materials and Methodology .....	19
5. Results.....	20
6. Discussion and recommendation .....	21
6.1 Zoning of the Restructured Lands.....	25
6.2 Commercial Applications.....	25
6.3 Housing or Residential Uses.....	25
6.4 Institutional.....	25
6.5 Industrial .....	26
6.6 Recreational or Open Sites.....	26
6.7 Infrastructure .....	26
6.8 Progress of LAC countries in Water Management .....	27
6.9 National Approaches.....	28
6.10 Prioritised Areas in Water Management.....	29
7. Conclusions.....	31
REFERENCES .....	33



## Abstract

The aim of this research was to identify the inequities that existed in the sustainable accessibility of drinking water considering the expenditure of water in Latin America and the Caribbean (LAC). The finding of the research is that there is a direct association between the accessibility of drinking water with (total and per capita household expenditures), the income of the household, location of the water plant, and economic state of the household. The conclusion is that green economy in LAC will be effectual with increased efficiency in socioeconomic, political, and environmental progress towards sustainable development.

**Key words:** water management, Latin America and the Caribbean, sustainability, service delivery, water supply, household.



## Introduction

The availability of water resources is under threat in Latin America and the Caribbean (LAC) due to intensive population pressure and swift urbanisation in these regions. According to Ringler, Rosegrant and Paisner (2000), the LAC region has a heavy presence of water resources that have been tapped by humans to provide water for irrigation. Poor water quality problems have made it necessary to utilise waste water for irrigation. Thus, investments in irrigation projects within the LAC region are very limited. Other than the water used for irrigation, water supply to homes, industries, and other social consumers has a high demand due to the changing environmental/ social situation of people who seek to enjoy forests, or have agricultural concerns relating to forests and agriculture occupations of people (Ringler et al., 2000).

In a meeting by the Inter-American Institute for Cooperation on Agriculture (IICA) in June 2013, delegates from up to 25 countries in LAC agreed to integrate new models for water management as agriculture, industrial and energy production compete for this resource (Caribbean Community, 2013). Agricultural production among the LAC countries is the greatest consumer of water at 70%, with the greatest need being awareness of how to utilise the water sustainably. According to the Caribbean Community (2013) the annual availability of water in Haiti stands at below 1700 m<sup>3</sup> (per person) while that of Suriname is at 300,000 m<sup>3</sup> (per capita). The difference in consumption is inherent not only due to the difference in availability but especially due to the policy gap in public agencies (OECD, 2009; United Nations Development Programme, 2004).

Ringler et al. (2000) stated that the conflicting goals among the LAC countries made it difficult for stakeholders to agree on a common policy in formulating outstanding water management functions. For example, for more than 36 years, Colombia has considered various water management strategies, including quality/ quantity regulatory (controls), price signals (for effectual use) and obligatory investment in water management (Canales Dávila, 2011). These policies have been hindered by economic challenges and poor enforcement by the institutions in charge. In Colombia, the price signals have continuously been fought by lack of political will from the national authorities as it curbs the use of natural resources against the wishes of the majority (Carrascos Mantilla, 2011).



## 1. Water Resources in the LAC Region

Natural forests that act as the main water catchment areas in LAC territories occupy up to 47% of the overall surface area (United Nations Environment Programme, 2003). According to the Organisation of Eastern Caribbean States (2013) 95% of the LAC region (i.e. 852 million hectares, or ha) is a tropical region that consists of Central America, the Caribbean Islands and the sub-tropics of South America (United Nations Environment Programme, 2003). The remaining 43 million ha in LAC is found in the temperate region of South America consisting of Argentina, Chile and Uruguay (United Nations Environment Programme, 2003). The largest forest areas are however, found in the Amazon and Guyana region.

In addition, the Amazon and Plate rivers contain the most financially productive estuaries in the Atlantic Coast as well as the Guayaquil and Fonseca on the Pacific Coast (United Nations Environment Programme, 2003). According to the Organisation of Eastern Caribbean States (2013) water that is located offshore of Peru and Chile contain the world's five largest fishing territories. Additionally, Argentina and Uruguay's off-coast waters are the most rapidly growing water masses in the planet earth (United Nations Environment Programme, 2003).

## 2. Regional Situation of Water Management in LAC

The Supply of water and the coverage of sanitation have been improved in LAC by UN led principles (Osinde, 2008). When considered on a regional basis the UN Millennium Development Goals (MDGs) helped to lower the percentage of people who did not have access to safe drinking water by half in the LAC nations. The only exception has been Haiti, the Dominican Republic, Peru, and Jamaica (Canales Dávila, 2011). In the aforementioned countries, the service quality of water is poor. Inadequate infrastructural development can cause losses of 50-75% of water (Hankte-Domas & Jouravlev, 2011). Rural areas in most LAC countries have a lower coverage, with the areas with inadequate drinking water and proper sanitation services being the most impoverished (Solanes & Jouravlev, 2006). More than 70% of the untreated sewage water is disposed in the nearest water bodies in LAC countries with 120 million people suffering from poor sanitation and 40 million lacking safe water to drink (Canales Dávila, 2011).

The United Nations (UN) Environmental Programme (UNEP) conducted its 14<sup>th</sup> meeting of the *Forum of Ministers of Environment of LAC* (United Nations Environment Programme, 2003) in Panama to discuss on water resource management and establish a policy directive. The meeting established that while water is essential to development and with LAC controlling 30% of the global water resources, there was still irregular distribution of population in line with the resources. Greater populations in LAC regions live in areas where water is scarce, polluted, or unavailable. Urban centres in LAC lacked adequate sanitation services that have led to detrimental health problems especially for poor inhabitants. Areas with such poor sanitation are also faced with frequent flooding, landslides, and erosion, as well as other climate change problems that hinder water supply (Kay, 2011; United Nations Environment Programme, 2003).

Solanes and Jouravlev (2005) state that the gravity of the water resource policy matter made the Heads of State- of the world convene at the UN in 2000 to adopt Millennium objectives. The Millennium Development Goal (MDG) was to lower by half the percentage of the world population that had inadequate access to safe drinking water and basis sanitation by 2015 (Inter-American Development Bank, 2005; Solanes & Jouravlev, 2005). Among the LAC countries, Mexico has catalogued water management as a “matter of national security” (United Nations Environment Programme, 2003). Further, Beekman & Biswas (1998) state that LAC established the IICA, whose mandate is to ensure the propagation of sustainable agricultural development in LAC. Agriculture plays a vital role in the sustainability of LAC and thus the body was mandated to promote the management of water in all countries in the 21<sup>st</sup> Century (Beekman & Biswas, 1998).

According to Bitran and Valenzuela (2003), the challenges of water management

are visible in the Andean Countries that encounter El-Nino Southern Oscillation (ENSO). In Brazil the risks are also visible due to the succession of lengthy drought sessions in the northeast section of Brazil. Climate change is seen to cause varied effects on the management of water resources in LAC countries as well as in Central America. There are three main areas adversely affected in this management:

- Quality, quantity and availability of water for general uses;
- Deterioration of the coastal regions due to the increase in sea-levels. This damage destroys the river regimes; and
- Increased number/ intensity of hurricanes and tropical storms caused by risen ocean surfaces and air temperatures. This rise leads to economic damage (World Water Assessment Programme, 2012).

Empirical research shows that Small Island States (SIDS) are chiefly vulnerable to water resource stresses (Cashman, Nurse, & Charlery, 2010; Falkland, 1999; Payet & Agricole, 2006). The Caribbean States that make up these SIDS signed the Johannesburg Plan of Implementation (JPol) at the Johannesburg World Summit on Sustainable Development in 2002 (Global Water Partnership, 2014). The purpose of this summit was the placement of the water use efficiency (WUE) plans in the Caribbean by 2005. The intent was to pave the way for further progress in Latin America. However, at the Caribbean Community's Ministers meeting on the environment in April 2008, the Caribbean States had not yet implemented or adopted the JPol objectives (Caribbean Community, 2011). The experts also introduced the economic value of water as well as its environmental and social aspect that was beneficial in society. Thus, economic tools were necessary in the facilitation of IWRM and making sustainable decisions on water policies.

Environmental management and implementation of water policies were seen to be dependent on policy learning initiatives among LAC nations. Kraemer, Pielen and Gorlach (2004) made a presentation on the exchange among water experts/engineers from LAC countries and Central America on Integrated Water Resources Management (IWRM) held in Costa Rica in 2004. The presentation revealed that experts sided with the economic dimension that had to be incorporated in order to establish IWRM policy. According to Kraemer *et al.* (2004) water was described as an economic good and a production factor that is essential to economic development in LAC. The 4<sup>th</sup> Dublin Principle stated that "*Water has an economic value in all its competing uses and should be recognised as an economic good*" (International Conference on Water and the Environment, 1992). The presentation viewed the following economic aspect of water that the LAC nations were supposed to adopt in order to strengthen the water management policies and IWRM.

According to Kraemer *et al.* (2004) the cycle of water management from production to consumption is viewed in line with its economic good that is valued as price

(charges) or tax to the government during consumptions. In its abstraction the government is able to gain tax while it issued tradable permits to the abstractors. The supply of water incurs a tax that helps the government to give out subsidies when consumers are found utilising water saving schemes. While water management is viewed as tedious, the advantages derived from proper management are seen to cycle between the government, producers and consumers. Thus, viewing water as an economic good and making policies based on its value is the first aspect before adopting water management policies.

### 3. Impact of the Water Management Problem in LAC Countries

The majority of the individuals in LAC nations are faced with inequity in terms of their water supply, while the sewerage services are equally poor (Inter-American Development Bank, 2011; United Nations Environment Programme, 2003). This inequality seeps down towards the accessibility of water, pricing and the service quality. According to Alegría Calvo and Cariola (2004), the poorest 5% of the LAC population are credited with 40% of the coverage for sanitation, while the 5% at the top of the economic strata account for virtually 100%. In essence, while the poor people in LAC nations receive less water supply and of poor quality, they pay expensively for this commodity. In Haiti, its capital city, Port au Prince, has 20% of its population living in slums. The population spends the majority of their budget on accessing safe drinking water. The Northeast area of Brazil is a semi-arid area that hosts the world's highest population concentration. The area faces a very scarce water supply. The result is that this area is the largest poverty zone on the South America continent (United Nations Environment Programme, 2003).

The Mexican government established an advisory Board on Water Services that took charge of water management and disposal of waste water in the country (Rosenberg, 2011). The Board took issue with the fact that 95% of Mexican rivers were polluted. It thus introduced the intention to ensure that half of the country's municipal wastewaters were treated by the year 2006 (United Nations Environment Programme, 2003). One of the critical areas was the Guaymas Municipality in Sonora, Mexico.

It was made a victim of pollution through agricultural and poor irrigation technologies that led to a loss of soil fertility. Poor agricultural techniques by Mexican farmers have also increased soil erosion that is rapidly turning most cities in Mexico into unfertile lands. These adverse effects were seen to cause deterioration of the renewable resources in the LAC region.

According to United Nations Environment Programme (2003) the LAC region has 30% of the global water resources that can be harnessed to supply an ample supply of renewable water. Most of these resources are located in the Amazonia region (Peru, Colombia and Brazil). However, Amazonia has a low population density as compared to other densely populated areas with high population densities. Regions such as Central and Northern Mexico; Northeast Brazil provide the driving force of some of the LAC economies but are adversely affected by the arid/ semi-arid conditions. The three water basins that include: (Gulf of Mexico, Southern Atlantic and the River Plate Basins) only cover 25% of the LAC region supplying 40% of the population. However, this resource cover is only worth 10% of the total water resources that are found in the LAC territory (Kay, 2011; United Nations Environment Programme, 2003).

Based on the institutionalisation of water management in the LAC region, there have been a number of transformations in water supply and resource development (Springer, 2010; Smits et al., 2009). The 20th Century saw the privatisation of most water development stations in LAC regions that were formally in the hands of the governments. Currently, more than 60 million customers have turned to private operators in LAC while the public sector is in charge of up to 320 million (United Nations Environment Programme, 2003). This privatisation was meant to tackle the water availability problem in the Caribbean Islands that had a high ratio of population density against water availability. Countries such as the Antigua and Barbuda, the Bahamas and Barbados have licensed private desalination plants to improve water quality and provide safe drinking water (Merla & Simmons, 2012; United Nations Environment Programme, 2003; Brewster & Mwansa, 2001). On the other hand, 97 aquifers in Mexico out of the total 654 have been over-exploited (United Nations Environment Programme, 2003). These aquifers are in charge of supplying close to 50% of the population demand. Other than the 97 over-exploited aquifers, an additional 17 aquifers were reported to have saline intrusion into their ground water supply (United Nations Environment Programme, 2003). Large portions of the country of Mexico are now turning into semi-arid areas. This is of heightened concern since these locations are the home of the largest economic activities in the country. The Amazonian region in the northern section of Brazil has a lower population, combined with an abundant supply of water. However, the north-eastern section of the country, with a higher population, faces a myriad of water supply problems due to water pollution (Organisation of Eastern Caribbean States, 2013).

In a policy document by the World Health Organisation (WHO), titled Policy for Health for All, health equity was ranked as the second target to be achieved among 38 objectives (Rangel Soares et al., 2002). The policy document stated that the health gap among socioeconomic country groups would be reduced a quarter- in all member states by the year 2020 (Rangel Soares et al., 2002). In addition, the Pan American Health Organisation (PAHO) made it mandatory to consider the accessibility of safe water to drink, and water to use for sanitation as the chief determinants of health in its member states (Pan American Sanitary Bureau, 2001). In view of this fact, PAHO conducted research in 11 LAC countries that would give an overall explanation to the situation of water integration management in the entire region. The results would in turn help LAC governments to establish programs at both local and international levels that made water management plans (Rangel Soares et al., 2002). Table 1 shows the development indicators 11 Latin American and Caribbean countries. In the study, the Human Development Index (HDI) entailed long life, knowledge acquisition, and being able to enjoy a decent standard of living.

## 4. Materials and Methodology

This descriptive research allowed a review of literature on the subject of water management in LAC. Out of the 33 countries found in the LAC region, this research considers only 11 countries. These 11 countries were selected based on the criterion of available survey data on household economies dating from the period 1995 to 1999. While the main variables include household income and domestic expenditures, the research used other modules that consisted of education, health situations, employment capacities and general living standards (Cleaver et al., 2005). The objective of this research was to identify the inequities that existed in the sustainable accessibility of drinking water in light of the expenditure of water in terms of household per capita (Rangel Soares et al., 2002). Further, the study aimed at determining the approximate proportions of household expenditures that were spent solely on water resources among the 11 LAC countries.

The methodology adopted by this research was a descriptive research design that used a multi-purpose household survey research instrument to collect data from 1995 to 1999 in the chosen countries (see Table 1). The study used the Living Standards Measurement Survey Study (LSMSS) that collected data on the drinking water availability and per capita household expenditures (Rangel Soares et al., 2002). These expenditures were analysed based on their socioeconomic factors like “urban vs. rural settings, income of the households”, nature and frequency of water supply provision, allocated time in collecting water other than that of running water (by municipal or government agency) and any treatment facility used for the collected water (Rangel Soares et al., 2002).

**Table 1.** Development Indicators for 11 Latin American and Caribbean Countries.

LAC Country	Human Development Index (HDI)	Life expectancy	Purchasing Power parity	Gini
Brazil	0.747	6.625	67.2	60
Bolivia	0.589	2.269	62.2	52
Chile	0.847	8.787	75.2	58
Colombia	0.764	6.006	71.0	57
Ecuador	0.589	3.003	69.9	53
El Salvador	0.696	4.036	69.4	52
Jamaica	0.735	3.389	75.0	36
Nicaragua	0.631	2.142	68.5	50
Panama	0.776	5.249	74.0	57
Paraguay	0.736	4.288	70.0	59
Peru	0.739	4.282	68.9	5

Fuente: Rangel Soares et al. (2002).

## 5. Results

There is a direct association between the accessibility of drinking water with total and per capita household expenditures), the income of the household, location of the water plant and economic state of the household (Rangel Soares et al., 2002). In the case of different families having similar income levels, the accessibility of safe water to drink in rural areas is more restricted when compared to that of urban areas (Akhmouch, 2012). Families living in rural households with high income levels have similar accessibility of water services as families living in urban areas with low income. More time is spent among families with low income and with no water supply systems in their homes. Poor households have limited accessibility to water treatment mechanisms because of the high cost. Low-income families are seen to access poor-quality water and thus are more vulnerable to diseases and infections (Cashman et al., 2010).

## 6. Discussion and recommendation

Countries have various views of land use planning due to the difference in culture (Springer, 2010). The social and economic demands for using land change on a daily basis. These circumstances demand a serious consideration into the nature of planning and the historical evolution of the area (Springer, 2010). Conceptions of land use planning will need to be changed if car ownership becomes widespread in areas that previously did not have a glut of vehicles. Similarly, if affordable housing peaks and social exclusion occurs, it will be necessary to change the conceptions of land use planning currently in existence (Bitran & Valenzuela, 2003). Land use planning has been used in towns and rural areas to help ensure that nature conservation interests are preserved, and land is retained for use in agriculture, forestry, and registration uses (Castro, 2008). Areas that can be utilised for development are also considered in land use planning.

Environmental regulation involves the integration of land use plan procedures with the aim of reaching sustainable development. Any development has to incorporate a water supply system that will ensure that every resident of a town or city accesses water. Pollution control measures have to be set in place and regulations defined (Solanes & Jouravlev, 2005). Proper planning provides methodologies for pollution to be dealt with before a plan is formally implemented. Controls that must be put in place include air emissions from vehicles, factories, and households. Waste management is also a major pillar in this sector (Bitran & Valenzuela, 2003). Towns must have a disposal site that will be managed by the town council in a permanent capacity; the site can be on a variety of locations and can be developed on a flexible timescale. This will help the council to integrate the needs of both contractors and the area residents through a well- stipulated framework of waste management (Solanes & Jouravlev, 2006).

Countryside policy involves protection of the regional, coastal, mountainous, or other geographic features. Developing adequate countryside policy ensures that these areas will be accessible and protected. In this application, the term 'planning' applies to the conservation of nature, including trees, air, soil, and water. Adequate planning also supports regeneration and conservation of water resources through sustainable abstraction of water (Merla & Simmons, 2012). Sustainable development promotes the utilisation of regional planning. In order for sustainable development to proceed, it is imperative for adequate national and regional planning to take place, and to have a long-term orientation towards planning modalities.

Regional planning should utilise a systemic and holistic approach (Rangel Soares, 2001). Regions are divided by the natural conditions they are endowed with (Rogers & Hall, 2003). These designations have enabled planners to formulate the urban policy that maintains urbanization and the growth of populations either to

settle in a given location or to travel to search for employment. Regeneration is maintained through loans, grants and other funds that ensure the progression of economic prospects that will sustain people. In the end, the main idea is to promote conservation of water resources in relation to nature, including levels of capital, labour, and energy supplies and utilisation. This is the backbone of sustainable development (Rogers & Hall, 2003).

Built up urban areas, those scheduled for growth and leisure parks, must be considered in land use planning (Caribbean Centre for Money and Finance, 2013). Before land use planning in the LAC region began, land exchanged hands at the value of the existing use. There was no way to take account of a projected increase in value that would be associated with any proposed development or any of the needs that might be planned. This view of the system of land use was restructured as development evolved. The new views were based on the need to protect the environment, control pollution, deal with poverty in urban areas, the need to establish adequate housing, and the need to transport the population from place to place. A strategic plan was also formulated with the development plans of the land use planning reflecting the lowest level of the planning hierarchy. All these factors influenced the local authority's stake on land use.

Water resource management planning involves the processes that formulate strategies that will aid in making decisions for future water management (Bitran & Valenzuela, 2003). The decisions are meant to achieve the goal of water availability through safe abstraction and supply procedures. The process is driven primarily from the public sector; the process helps to influence private firms' activities. Water resource management planning uses regulations, guidance and incentives to influence activities of households and firms. The process of reviewing a planning system commences with understanding the policies and procedures of public institutions. Water resource planning, like land planning, is also focused on the physical, economic and social environment.

Location theories attempt to explain the spatial structure of land. Location theory is applicable when compared with the land use explanation. Location theory utilizes a three-dimensional space representation, rather than a two-dimensional view of the land. Development of the new theories has sparked land use zoning procedures that have maximized taxation and enterprise on the part of the public. The theory of spatial organization of cities in urban planning introduces the idea of paying rents. It also puts a price tag on a piece of land in an urban set up. However, the real value of spatial planning in city areas may be that it influences settlement of people. Spatial planning ensures distribution of people based on geographical timelines and environmental planning. It is this idea that initiated the paying of rent and taxation from the government's perspective (Deák, 1985; Lloyd & Dicken, 1977; Friedmann, 1973). According to Hall (1994), "Spatial planning at the scale of a city region only functions with elements such as main roads, major new industrial areas

and associated housing schemes, ports and airports” (p. 113).

According to Bitran and Valenzuela (2003), the planning has been associated with drawings and designs of buildings in urban set ups ever since the Greco-Roman era. Nevertheless, land use planning is more concerned about the natural or built environment which does not necessitate designs. What is important is to formulate strategies that can protect these environments upon implementation. In addition, the goals of a plan include equal redistribution of resources, permanence of the built stock, biodiversity conservation, urban development, and sustainable development (Bartram et al., 2009). With this in mind, the two most important areas of planning in the LAC territory include land use policy and environmental policy planning. These two general policy areas have enabled the establishment of various policies specific to land use and environmental applications.

Policies such as transportation, development of housing facilities, consideration of needs of inner cities, and pollution control must be incorporated in the planning of water management. These policies have goals that depend on accurate planning procedures. Earlier, it was discussed that urbanization among LAC countries has been influenced by policies that address the entire countryside (Bitran & Valenzuela, 2003). Urban regeneration should be considered as part of the urban water management policy. It promotes natural physical environments both within and outside of the cities, as well as promoting safe and practical environments that will be erected both in and outside of the urban areas. Urban, countryside, land use, and environmental policies, when taken together, outline plans for how to handle transportation and housing issues within cities.

Land which had been rendered incapable of reasonable use was to be reclaimed by the Local authority through a series of planning decisions (Sanctuary, Haller, & Tropp, 2004). However, organizational arrangements were given top priority instead of the original priorities, which were to be land use planning and planning for roads. Nevertheless, land use provided a good map to coordinate public activities and offer development procedures. With time, the process of planning evolved, and large gains were made in the planning arena (Portes, Dore-Cabral, & Landolt, 1997). They were meant to control usage of land from negative covenants while prohibiting unfair actions that might negatively impact the land. Understanding this helps to understand the role of land use planning.

Environmental needs are also captured in this aspect. Among them include healthful housing and other built environments, including schools and workplaces; and infrastructure development, such as roads, storm drainage, sewage, solid and water supply systems. Urban centres are developed with green areas such as community parks and green fields that act as recreational sites. However, urban land use planning seeks to control industrialization and development of settlement areas through increased population on uptake of social amenities such as hospitals

and schools (Hinds, 2001). Table 2 shows a cost and benefit analysis for developing of a water treatment course in an area within the LAC region.

**Table 2.** Potential Costs and Benefits Associated with Establishing a Water Treatment Plant.

Area of land/ Opportunity Costs	Cost	Benefit
Agricultural land (largest percentage in LAC territory)  Settlement  Forest	Overall produces Loss of non-use value that include landscape and cultural value Compensation costs (Deaton, 1997) Ecosystem services values; provisional values, climate regulating values, recreational values and passive values	Water  Finance/ money  Water supply/ delivery
The cost of developing the water treatment course, assuming the ecological conditions are perfect	Costs of design and construction, value/ costs of obtaining the agricultural land and private settlement, negative externalities e.g. noise, traffic etc. during construction (Mitchell, Agle, & Wood, 1997)	Water supply/ delivery
The existence of the water treatment course	Operation and maintenance cost  Negative externalities such as noise, traffic (Mitchell et al., 1997)	Amenity (water treatment) value- for service, conservation value of the safe drinking water and supply (from those who utilize this water)  The increase in the price of land Private housing development Revenue of water plant (tax, rent) Increase in employment opportunities Ecosystem services (Renewed water sources, air freshening, growth of trees) Increase in domestic and industrial development Aesthetic value of its being green open spaces (proximity) Fiscal benefits (increase in tax from businesses; increase in tax from property transactions (Global Water Partnership Caribbean, 2012)

**Source:** adapted and modified from Taylor (2010).

The table above shows how a private settlement is being converted into a water treatment. The land comprises residential structures and urban set ups. According to Bartram et al. (2009), compensation costs for settlements should be included to ensure land inhabitants in any LAC region acquire better land and afford the necessary amenities during the restructuring process. Forest areas should also be priced to prevent encroachment by poachers (Bartram et al., 2009). This takes into account the loss of any ecosystem services from deforestation. Another type of analysis includes econometrics. It factors in simulation models (Pan American Sanitary Bureau, 2001).

### **6.1 Zoning of the Restructured Lands**

Various uses of land in all cities within the LAC region are influenced by the zoning process. Common organized land uses in urban centres include commercial applications, residential facilities, industrial buildings and areas, institutional utilisation, infrastructure construction, and open or recreational land uses (Saleth & Dinar, 2005). According to Saleth and Dinar (2005), a point to note is that zoning of land is influenced by use, location, density and duration of activity that is to be organized. These will be outlined after the uses have been exhausted.

### **6.2 Commercial Applications**

To ensure proper water management in urban centres commercial development such as shopping areas (including retail and wholesale stores), office campuses, and hotels and restaurants, have to be connected to updated sewer systems (Osinde, 2008). These areas are mostly service oriented and are thus situated close to busy streets within the city centre that faces pollution (Fernández, Jouravlev, Lentini, & Yurquina, 2009). These commercial centres are prone to adverse environmental conditions such as population pressure and climate change hazards that degrade the value of the water supplied in the urban areas (Portes et al., 1997).

### **6.3 Housing or Residential Uses**

Houses and residential locations have the highest need for water resources (Jønch-Clausen, 2004; Canales & Jouravlev, 2012). In the LAC, housing and residential use areas are typically characterized by unique serene climate and warm weather. The places are also secluded from offices and other commercial centres.

### **6.4 Institutional**

Religious and educational centres are situated close to residential neighbourhoods to facilitate accessibility. Countries such as Chile, Brazil, Colombia, and Bolivia preserve natural forests for religious purposes (Charbit, 2011). This conservation helps to maintain water management in these LAC countries. They give room for multi-cultural advancements (Organisation of Eastern Caribbean States, 2013). The areas are also sites that offer both employment and tourist attractions, serving as economic centers. In general, these areas are located in towns but away from heavy

traffic. These locations ensure decongestion of arid areas in various LAC regions such as Northeast Brazil, Mexico and Jamaica that currently have only have households, and no institutions (Charbit, 2011).

### **6.5 Industrial**

The industrial area is left for manufacturing, warehousing and storage activities (Batley, 2004). As a driver of the economy, this area should also be secluded as it emits pollutants, odors, and waste. It is a basic employment base in any economic set up. Industrial areas are located in the outskirts of towns away from residential areas (Organisation of Eastern Caribbean States, 2013).

### **6.6 Recreational or Open Sites**

Water is necessary in open regional fields (Springer, 2010). Open regional fields and recreational sites bring back a reconnection with nature with a vast feel of the biodiversity. Such areas include plazas, parks, and green locations, including those inside cities (Caribbean Centre for Money and Finance, 2013). These areas are characterized by trees, wildlife and large tracts of land; they are also beneficial as water catchment areas.

### **6.7 Infrastructure**

Infrastructure connects and supports the city. It enjoins each and section of city or urban areas that have been defined in the previous paragraphs. Infrastructure enables smooth running of daily operations, including those that facilitate environmental planning. It includes roads for public transportation, sewer systems, and basic utility lines that are the backbone of an economy. A backlog of waste in an area hinders production of new items. Infrastructure needs must be given top priority if planning is to be successful (Alegria Calvo & Cariola, 2004).

Countries in the LAC region have poor water delivery systems due to poor water management systems and inadequate land use planning. Land use planning involves restructuring objectives and ideas to suit basic environmental needs of the area. Various policies in LAC territories are developed to improve water management strategy. They include healthful housing and other manufactured environments such as schools and workplaces; and infrastructural development such as roads, storm drainage, sewage, solid and water supply systems. Urban land use planning is somewhat different, as it seeks to control industrialization and development of settlement areas through increased population with respect to uptake of social amenities such as hospitals and schools. In addition, urban population growth in developing countries is a direct show of the spatial concentration of people and commercial services. Planning is thus essential for sustainability of the water management systems (Springer, 2010).

Urban planning ensures each activity has its own segregated plot of land within

the urban set up (Deaton, 1997). Moreover, planning ensures the distribution of economic benefits to the locals so as to meet the social or corporate objectives or responsibilities. Effective economic management is enhanced by democratic planning that allows government to establish water management resources (Deaton, 1997; Springer, 2010). It initiates a framework that brings together efforts that will be followed not as commands or controls but as pathways to realization of individual goals such as growth of commercial centres. Analysis of costs and benefits is best used to identify opportunities and costs of turning a particular part of the environment into various activities such as a water treatment course. More importantly, the most successful urban centres have evolved from zoning procedures.

Urban zones demarcate various areas relating to density or concentration of population and duration of activities that can be supported. Uses that have been identified in this report include infrastructural, industrial, commercial, residential, and recreational uses. The report has also considered the globalization of shopping malls in terms of development. Factors as the social media that have quickened the process. In the future, however, it is likely that shopping will be without borders. As this globalized and internationalized retail system continues to evolve and develop, planners will have to rethink their design systems to fit the market.

Land use plans ensure that similar businesses are placed together. It separates unlike economic entities from close proximity to each other (Deaton, 1997). Factories and sewerage industries are required to be placed away from homes and administration offices to ensure proper segregation and delivery of water to the respective destinations (Mandal & Haiduk, 2011). This zoning was applied in Mexico to ensure concentration or clustering of similar business in the form of a dense set up. The decrease of arable land, especially in the north-eastern section of the country, made it mandatory for urban planners to give the population of area inhabitants and the carrying capacity of land (United Nations, 1994).

### **6.8 Progress of LAC countries in Water Management**

The UN conducted the Zaragoza Conference ahead of the Rio 20 to discuss on the progress of water management and the furtherance of a green economy in LAC countries (Canales & Jouravlev, 2012). The conference established that water is essential for the actualisation of a green economy in LAC through technology and innovation. Thus, green economy in LAC will be effectual with increased efficiency in socioeconomic, political, and environmental progress towards sustainable development. At the heart of the insufficient water management strategies and maintenance lay poverty-stricken nations and land-use challenges that prompted inequity in delivery and sharing of water resources. The conference also identified the need for the public to be made aware of the importance of water management and land use planning, as well as the importance of participation of stakeholders in the planning and development process. The City of Cochabamba, Bolivia, was faced

with improper water management in the adoption of its management technology due to poor involvement of communities in decision-making (Canales & Jouravlev, 2012). Although this is obviously to be avoided, the point is that each country in LAC must adopt various management approaches to maintain fresh water supply to its citizens, in a manner appropriate for those nations and citizens.

## 6.9 National Approaches

Various countries within LAC use different approaches in managing water resources. These approaches are compared and contrasted below.

**Chile.** Unlike many countries in LAC, Chile adopted the concept of full cost recovery taxes or tariffs. These tariffs act as signals to water consumers with the poor households getting subsidy systems (Cashman, 2012; Canales & Jouravlev, 2012). The Chilean government ensured that all providers of water amenities and sanitation had financial assistance in providing their services, especially in supplying the service to poor households in Chile. However, rather than adopting low set tariffs, it is vital for the government to change the tariffs to cost-recovery ranks with sustainable public investment to create subsidies for the poor. Chile has also reformed legislation pertaining to the provision of water and maintenance of the water supply (Charbit, 2011; Ferro, Lentini, & Romero, 2011). It has also authorised the allowance of privatisation of water utilities to aid in faster supply.

**Mexico.** To curb the rising demand of water for agricultural purposes, Mexico has renewed its water laws to establish river basin councils (Charbit, 2011; Canales & Jouravlev, 2012). Through its National Water Commission of Mexico (CONAGUA) the country is working towards green economy by treating water in its aquifers and formulating the Water Agenda 2030 (Canales & Jouravlev, 2012). This agenda was established through a participatory process to bring water issues before the public as priorities. Other countries that have reformed their water laws, including Honduras, Peru, Nicaragua, and Venezuela (among others).

Water laws clearly indicate the area or state from which a water body is found and under whose domain it belongs (Charbit, 2011). These water laws also show the rights of using the water and the conditions of using the water resource for its beneficial aim. These laws are also incorporated in the constitution of the respective LAC countries; they are protected using private property clauses when necessary (Canales & Jouravlev, 2012). The water laws recognise the traditional or religious uses that indigenous peoples had for a water resource had prior to the legislation of water law and support these traditional uses. This regulation helps to maintain reasonable tariffs to the water supplied as well as subsidy systems that will help low-income earners in the respective LAC countries.

**Bolivia.** The government of Bolivia in 1999 allowed for the privatisation of the water

supply and the provision of sanitation services in Cochabamba when it authorised Aguas del Tunari, a multinational company, to undertake the process of privatising (Canales & Jouravlev, 2012). However, the company failed to conduct the necessary public participation requirements before jumpstarting the water management process, necessitating the government to award a concession contract with an obsolete law, No. 2029. The company, along with the government of Bolivia, was faced with street protests due to its rate hikes that the public described as being excessive. The protests turned violent in 2000, when the government insisted on continuing with the contract. Public concern was so high and so vocal that the contract was terminated later in 2000. The Government of Bolivia has since drafted and approved a new water legislation, No. 2066, that took into consideration public participation and considerable rates.

**Brazil.** Following the long drought in Brazil and the ENSO experience, the government decided to pass laws to improve the “quality, quantity and availability” of water supply by protecting its river basins. The government has halted destruction of the Amazon Forest that would lead to the damage of coastal front and propagate rise in sea levels. They have also put in place structures to protect aquifers for fresh water from intrusion by saline water due to unregulated borehole drilling (Intergovernmental Panel on Climate Change, 2007). According to Cleaver *et al.* (2005), Brazil’s new water laws that have established a water management policy at the national level to aid in changing water as an economic good and improve access to safe drinking water/ sanitation for the public. These reforms have made Brazil into a leader in successful water management policy implementation since 1997 (Canales & Jouravlev, 2012).

### 6.10 Prioritised Areas in Water Management

The Zaragoza Conference led to a number of areas of water management that needed to be adjusted and prioritized. LAC is seen to prioritise the following areas in water management as per the Zaragoza Conference (Canales & Jouravlev, 2012). These areas are explored below.

**Agriculture.** LAC countries agreed to use water to attain food security. The countries also agreed to increase efficiency and favourable nutrition per drop of water. The countries would use the value of the food chain to improve water efficiencies. LAC countries also agreed to counter agricultural challenge by green technology in small farms (Sanctuary, Haller, & Tropp, 2004).

**Cities and Urban Settlements.** The countries agreed to implement the MDGs to actualise the supply of basic water services and sanitation to the citizens. The governments agreed to consider alterations in water consumption in order to identify direct and indirect consumer patterns. Private and public agencies in charge of supplying water in urban areas were required to be effective. The governments

also promised to tackle externalities accruing to cities due to adoption of water management systems in the environment.

**Industry.** In order to maintain industrial growth, the governments maintained the need to change the patterns of industrial production. Industries were required to be secluded to reduce pollution. Innovation was seen as a necessary tool towards the green economy in industrial growth. Small, medium and large companies were required to reduce carbon emissions that had resulted increased effect of climate change.

**Watersheds and Aquifers.** The countries found it necessary to manage watersheds and aquifers in order to keep them being contaminated by pollutants. These resources are very scarce in LAC territories. The aquifers are necessary to provide water resources in case of floods and drought due to their natural preservations.

These resolutions show that water security is the primary goal in water management in LAC countries. Effective water management systems allow for the inclusion of healthy ecosystems while considering all facets of the economy. Water management is also necessary to reduce poverty and increase the generation of wealth by all people (Hankte-Domas & Jouravlev, 2011).

## 7. Conclusions

It is necessary for LAC countries to improve their water management services as well as sanitation in order to accommodate both high and low-income earners. Conduction of health assessment on national levels will help the governments to comprehend the per capita consumption of water and thus improve service delivery. Water supply to homes, industries and other social consumers has a high demand due to the changing environmental/ social situation of forests and agriculture. People in LAC countries are endowed with natural resources that should be preserved so as to ensure sustainable progression of water abstraction. Less populated areas, such as the Amazonia, that have abundant supply of water should be protected and the resource harnessed. Clear technologies should be used to increase water supply in the heavily populated areas.

Resolutions in aquifer/ watershed management, industrial/ agricultural growth and urban development show that water security is the primary goal in water management in LAC countries. Effective water management systems allow for the inclusion of healthy ecosystems while considering all facets of the economy. Water management is also necessary to reduce poverty and increase the generation of wealth by all people. Various LAC countries have adopted new water laws to aid in water management and securing the preservation of water resources. These water laws clearly indicate the area or state from which a water body is found and under whose domain it operates. Analysis of costs and benefits should be best used to identify opportunities and costs of turning a particular part of the environment into various activities, such as a water treatment course. More importantly is that urban centres have evolved from zoning procedures that have helped government in LAC to develop comprehensive water management systems.

In the past, water policies have been hindered due to lack of information on the right procedures of implementation. These policies have been hindered by economic challenges and poor enforcement by the institutions in charge. In Colombia, the price signals have continuously been fought by lack of political will from the national authorities as it curbs the use of natural resources against the wishes of the majority. It is also noteworthy to understand that water is essential for the actualisation of a green economy. LAC countries have constantly fought to adopt effective water governance through technology and innovation. Thus, a green economy in LAC will only be effectual with increased efficiency in socioeconomic, political and environmental progress towards sustainable development.



## References

- Akhmouch, A. (2012). *Water Governance governance in Latin America and the Caribbean: A multi-level approach*. Paris: OECD Publishing.
- Alegría Calvo, M. A., & Cariola, E. C. (2004). *Analysis of the Privatization Process of the Water and Sanitation Sector in Chile*. Geneva: United Nations Research Institute for Social Development.
- Bartram, J., Corrales, L., Davison, A., Deere, D., Drury, D., Gordon, B., Howard, G., Rinehold, A., & Stevens, M. (2009). *Water Safety Plan Manual: Step-by-step risk management for drinking-water suppliers*. Geneva: World Health Organization.
- Batley, R. (2004). The politics of service delivery. *Development and Change*, 35(1), 31–56.
- Beekman, G. B., & Biswas, A. K. (1998). Water management in Latin America and the Caribbean: role of IICA. *International Journal of Water Resources Development*, 14(3), 305-313.
- Bitran, G. A., Valenzuela, E. P. (2003). *Water services in Chile: Comparing private and public performance*. Washington, D.C.: World Bank.
- Brewster, L., & Mwansa, J. B. (2001). *Report on integrating management of watersheds and coastal areas in small island developing states of the Caribbean: The Barbados National Report*. (The Barbados National Report). Barbados: Caribbean Environmental Health Institute and United Nations Environment Program.
- Canales, C., & Jouravlev, A. (2012). *Water and a Green Economy in Latin America and the Caribbean (LAC)*. Santiago: Naciones Unidas.
- Canales Dávila, C. (2011). *Water and the green economy in Latin America and the Caribbean: regional context and lessons learnt*. Retrieved from [http://www.un.org/waterforlifedecade/green\\_economy\\_2011/pdf/session\\_7\\_lac.pdf](http://www.un.org/waterforlifedecade/green_economy_2011/pdf/session_7_lac.pdf)
- Caribbean Centre for Money and Finance (2013). *Caribbean Economic Performance Report – June 2013*. Retrieved from [http://www.ccmf-uwf.org/files/publications/economic\\_report/cepr\\_2013-12.pdf](http://www.ccmf-uwf.org/files/publications/economic_report/cepr_2013-12.pdf)
- Caribbean Community (2013). *IICA warns of water shortage*. Retrieved from <http://caricom.org/media-center/communications/news-from-the-community/iica-warns-of-water-shortage>
- Caribbean Community (2011). *CARICOM forges ahead with strategies to manage its water resources*. Retrieved from [http://archive.caricom.org/jsp/pressreleases/press\\_releases\\_2011/pres20\\_11.jsp](http://archive.caricom.org/jsp/pressreleases/press_releases_2011/pres20_11.jsp)

- Carrascos Mantilla, W. (2011). *Políticas públicas para la prestación de los servicios de agua potable y saneamiento en las áreas rurales*. Retrieved from <http://repositorio.cepal.org/bitstream/handle/11362/3842/1/S2011912.pdf>
- Cashman, A. C. (2012). Water policy development and governance in the Caribbean: an overview of regional progress. *Water Policy*, 14(1), 14–30.
- Cashman, A., Nurse, L., & Charlery, J. (2010). Climate change in the Caribbean: the water management implications. *Journal of Environment and Development*, 19(1), 41–67.
- Castro, J. E. (2008). Water struggles, citizenship and governance in Latin America. *Development*, 51(1), 72-76.
- Charbit, C. (2011). Governance of Public Policies in Decentralised Contexts: The Multi-level Approach. (OECD Regional Development Working Papers, No. 2011/04). Paris: OECD Publishing.
- Cleaver, F., Franks, T., Boesten, J., & Kiire, A. (2005). *Water governance and poverty: What works for the poor*. Bradford: Bradford Centre for International Development.
- Deák, C. (1985). Rent Theory and The Price of Urban Land (Tesis doctoral, University of Cambridge). Retrieved from [http://www6.fau.usp.br/docentes/deprojeto/c\\_deak/CD/3publ/85r-thry/CD85rent.pdf](http://www6.fau.usp.br/docentes/deprojeto/c_deak/CD/3publ/85r-thry/CD85rent.pdf)
- Deaton, A. (1997). *The analysis of household surveys: a microeconomic approach to development policy*. Washington: The World Bank Publications.
- Falkland, T. (1999). Water resources issues of small island developing states. *Natural Resources Forum*, 23(3), 245–260.
- Fernández, D., Jouravlev, A., Lentini, E., & Yurquina, A. (2009). *Contabilidad regulatoria, sustentabilidad financiera y gestión mancomunada: temas relevantes en servicios de agua y saneamiento*. Santiago de Chile: Naciones Unidas.
- Ferro, G., Lentini, E., & Romero, C. A. (2011). *Eficiencia y su medición en prestadores de servicios de agua potable y alcantarillado*. Retrieved from [http://repositorio.cepal.org/bitstream/handle/11362/37287/LCW385\\_es.pdf?sequence=1](http://repositorio.cepal.org/bitstream/handle/11362/37287/LCW385_es.pdf?sequence=1)
- Friedmann, J. (1973). The spatial organization of power in the development of urban systems. *Development and change*, 4(3), 12-50.
- Global Water Partnership (2014). *Integrated water resources management in the Caribbean: The challenges facing small island developing states*. Retrieved from [http://www.gwp.org/Global/ToolBox/Publications/Technical%20Focus%20Papers/04%20Caribbean\\_TFP\\_2014.pdf](http://www.gwp.org/Global/ToolBox/Publications/Technical%20Focus%20Papers/04%20Caribbean_TFP_2014.pdf)

- Global Water Partnership Caribbean (2012). *IWRM principles*. Retrieved from <http://www.gwp.org/en/The-Challenge/What-is-IWRM/IWRM-Principles/>
- Hall, P. (1994). "Evolution of strategic planning and regional development". In *Strategic Planning for Regional Development in the UK* (pp.10-27). London and New York: Routledge.
- Hankte-Domas, M. & Jouravlev, A. (2011). *Lineamientos de política pública para el sector de agua potable y saneamiento*. Retrieved from <http://www.cepal.org/es/publicaciones/3863-lineamientos-politica-publica-sector-agua-potable-saneamiento>
- Hinds, D. (2001). *Trinidad's Crisis: A Consequence of the Caribbean's Authoritarian Culture*. Retrieved from <http://guyanacaribbeanpolitics.com/?p=849>
- Inter-American Development Bank (2005). *The Millennium Development Goals in Latin America and the Caribbean: Progress, Priorities and IDB Support for their Implementation*. Washington, D.C.: Inter-American Development Bank.
- Inter-American Development Bank (2011), *Access to Water and Sanitation for all and the Right to Water*. Retrieved from <http://www.iadb.org/en/topics/water-sanitation/access-to-water-and-sanitation-for-all-and-the-right-to-water,4861.html>
- Intergovernmental Panel on Climate Change (2007). *Climate Change 2007: The Physical Science Basis*. Cambridge and New York: Cambridge University Press.
- International Conference on Water and the Environment (1992). *The Dublin statement on water and sustainable development*. Retrieved from <http://www.wmo.int/pages/prog/hwrp/documents/english/icwedece.html>
- Jønch-Clausen, T. (2004). "...*Integrated Water Resources Management (IWRM) and Water Efficiency Plans by 2005*": *Why, What and How?* (Tec Background Papers No. 10). Sweden: Global Water Partnership.
- Kay, M. (2011). *Water for Food: Innovative water management technologies for food security and poverty alleviation*. New York and Geneva: United Nations.
- Kraemer, R. A, Pielen, B., & Görlach, B. (2004). *Economic Dimension of Integrated Water Resources Management*. Retrieved from <http://ecologic.eu/sites/files/presentation/2013/Kraemer-Economic-Dimensions-of-Integrated-Water-Resources-Management.pdf>
- Lloyd, P. E., & Dicken, P. (1977). *Location in space: a theoretical approach to economic geography*. London y New York: Harper & Row.
- Mandal, A., & Haiduk, A. (2011). Hydrochemical characteristics of groundwater in the Kingston Basin. *Environmental Earth Sciences*, 63(2), 415–424.

- McIntosh, S., & Leotaud, N. (2007). *Fair deals for watershed services in the Caribbean*. London: International Institute for Environment and Development.
- Merla, A., & Simmons, D. (2012). *Final report of the terminal evaluation of UNEP-GEF project on integrating watershed and coastal areas management in the Caribbean small island developing states (IWCAM)*. GFL/6030-05-01. Nairobi: UNEP.
- Mitchell, R. K., Agle, B. R., & Wood, D. (1997). Toward a Theory of Stakeholder Identification and Salience: Defining the Principle of who and What Really Counts. *Academy of Management Review*, 22(4), 853–886.
- OECD (2009). *Strategic Financial Planning for Water Supply and Sanitation: a report from the OECD task team on sustainable financing to ensure affordable access to water supply and sanitation*. Paris: OECD Publishing.
- Organisation of Eastern Caribbean States (2013). *Water sector model act for OECS*. Retrieved from [http://www.oecs.org/uploads/jobs/Water\\_Sector\\_Model\\_Act\\_Climate\\_Change\\_May\\_12.pdf](http://www.oecs.org/uploads/jobs/Water_Sector_Model_Act_Climate_Change_May_12.pdf)
- Osinde, R. (2008). *Review of Existing Concepts of Water Governance and an Analysis of Pro-Poor Approaches in UN-HABITAT Interventions*. Nairobi: United Nations Human Settlements Programme.
- Pan American Sanitary Bureau (2001). *Equity & Health: Views from the Pan American Sanitary Bureau*. Washington, D.C.: Pan American Health Organization.
- Payet, R., & Agricole, W. (2006). Climate change in the Seychelles: implications for water and coral reefs. *AMBIO: A Journal of the Human Environment*, 35(4), 182–189.
- Portes, A., Dore-Cabral, C., & Landolt, P. (1997). *The Urban Caribbean: Transition to the New Global Economy*. Baltimore and London: The Johns Hopkins University.
- Rangel Soares, L. C., Griesinger, M. O., Dachs, J. N. W., Bittner, M. A., & Tavares, S. (2002). Inequities in access to and use of drinking water services in Latin America and the Caribbean. *Revista Panamericana de Salud Pública*, 11(5-6), 386-396.
- Ringler, C., Rosegrant, M. W., & Paisner, M. S. (2000). *Irrigation and water resources in Latin America and the Caribbean: challenges and strategies*. (EPTD Discussion Paper No. 64). Washington, D.C.: International Food Policy Research Institute.
- Rogers, P., & Hall, A. W. (2003). *Effective Water Governance*. (The Background Papers No. 7). Stockholm: Global Water Partnership Technical Committee.
- Rosenberg, T. (2011, January 3). To Beat Back Poverty, Pay the Poor. *The New York Times*. Retrieved from [https://opinionator.blogs.nytimes.com/2011/01/03/to-beat-back-poverty-pay-the-poor/?\\_r=0](https://opinionator.blogs.nytimes.com/2011/01/03/to-beat-back-poverty-pay-the-poor/?_r=0)

- Saleth, R. M., & Dinar, A. (2005). Water institutional reforms: theory and practice. *Water Policy*, 7(1), 1–19.
- Sanctuary, M., Haller, L., & Tropp, H. (2004). *Making Water a Part of Economic Development: The Economic Benefits of Improved Water Management and Services*. Stockholm: Stockholm International Water Institute.
- Smits, S., Galvis, A., Bernal, D. P., Visscher, J. T., Santandreu, A., Oliveira de Nascimento, N., Sánchez, E., & Butterworth, J. (2009). *Sustainable Water Management in the City of the Future: D6.1.2 Mapping governance of urban environmental sanitation in Latin America: case studies from Belo Horizonte, Cali, Lima and Tegucigalpa*. Retrieved from [http://nl.ircwash.org/sites/default/files/d6.1.2\\_mapping\\_governance\\_latin\\_america.pdf](http://nl.ircwash.org/sites/default/files/d6.1.2_mapping_governance_latin_america.pdf)
- Rangel Soares, L. C. (2001). *Regional report on the evaluation 2000 in the region of the Americas: Water Supply and Sanitation, Current Status and Prospects*. Washington, D.C.: Pan American Health Organization.
- Solanes, M. & Jouravlev, A. (2005). *Integrando economía, legislación y administración en la gestión del agua y sus servicios en América Latina y el Caribe*. (Reporte 101). Santiago de Chile: Naciones Unidas.
- Solanes, M. & Jouravlev, A. (2006). *Water governance for development and sustainability*. (Reporte 111). Santiago de Chile: Naciones Unidas.
- Springer, B. (2010). *Barbados: public-private sector partnerships*. Santiago de Chile. United Nations y Secretaría General Iberoamericana.
- Taylor, T. (2010). *Cost benefit analysis of peri-urban land use policy: Application to case studies*. (Plurel Report No. 4.4.3). European Union: The PLUREL project.
- United Nations Development Programme (2004). *Water Governance for Poverty Reduction: Key Issues and the UNDP Response to Millenium Development Goals*. New York: United Nations Development Programme.
- United Nations Environment Programme (2003). *Water Resources Management in Latin America and the Caribbean*. (UNEP/LAC-IGWG.XIV/Inf.5). Panama City: United Nations Environment Programme.
- United Nations (1994). *Report of the global conference on the sustainable development of small island developing states*. (A/CONF.167/9). Bridgetown: United Nations.
- World Water Assessment Programme (2012). *The United Nations World Water Development Report 4: Managing Water under Uncertainty and Risk*. Paris: UNESCO.





