Socio-economic Analysis of the Sectoral Impacts of the 2014 Drought in Central America

Global Water Partnership
Central America

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Photo: Andrea Pacheco

This study is a socio-economic analysis of the sectoral impact of the 2014 drought in Central America. It was developed by GWP Central America, through the Water, Climate and Development Programme (WACDEP) and translated to English with the support of the GWP/WMO Integrated Drought Management Programme.

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GWP Central America, June 2016
English version, July 2016

Cover: Los Laureles reservoir in Tegucigalpa, Honduras by David Romero

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Executive Summary

This document provides an estimate of the cost of the 2014 drought to economic sectors of considerable importance in the region, which are significantly affected by decreased precipitation. These include the agricultural sector, which generates a significant portion of production in rural areas, and in particular provides employment to the most economically vulnerable population; the hydroelectric sector, which generates a substantial portion of power in the region; and the WASH sector, which is undoubtedly a necessary condition for human development. These three sectors provide various health- and hygiene-related benefits, among others, to the population.

The economic impact of droughts is manifested in a variety of ways depending on the sector. For example, drought triggers a series of events in the agricultural sector, such as crop loss, which not only affect producers directly through their loss of investment, but consumers as well, due to the increased prices that follow. In the case of hydroelectricity, a reduction in rainfall means that the capacity of the plant decreases, which is compensated by fossil fuel-based thermal generation. As for the water services, decreased precipitation usually translates into higher operating costs.

This report draws from secondary information produced in the region to put the loss into context and to quantify it in a systematic manner for all the countries of Central America. The introduction provides the background and the methodology for the study. Further on, Section 2 describes the 2014 drought from a physical point of view, i.e. in terms of changes in precipitation; Section 3 elaborates on the importance of each of the sectors from an economic perspective based on the revenues generated by each; Section 4 provides estimates of the drought's economic impact in each sector; Section 5 consists of a brief economic performance summary; and finally, Sections 6 and 7 offer some recommendations and conclusions.

The study concludes that losses in all three sectors are substantial, exceeding US$ 650 million; therefore, investments aimed at reducing vulnerability to climate change can be very profitable for countries from a socio-economic development point of view. The most vulnerable sector was agriculture, which suffered the greatest losses (approximately US$ 465 million), followed by hydroelectric (US$ 186 million) and WASH (US$ 1.5 million).

Introduction

Global Water Partnership (GWP) is an international network that promotes Integrated Water Resource Management (IWRM) as a means to achieve sustainable water use based on knowledge and the exchange of experiences. Its vision is that of a water secure world, and its mission is to advance governance and management of water resources for sustainable and equitable development.

GWP considers it essential to address the global challenges of today; climate change is one of the priorities. GWP Central America has been implementing the Water, Climate and Development Programme (WACDEP), which promotes water security as a strategic element for adapting to climate change and variability. The objectives of this programme are to incorporate climate change adaptation, risk reduction of related disasters and water security as cross-cutting themes; develop solutions to enhance climate resilience; facilitate institutional agreements; strengthen knowledge and institutional capacity; and strengthen the coordination of GWP's network with strategic partners.

One of the WACDEP work areas includes the mainstreaming of water resource-related investments into development plans and strategies at national and regional levels. A good management tool to implement this work area consists in a multi-sector analysis of the economic impact of climate change on water resources.

The objective of the consultancy was “to estimate the economic impact of the 2014 drought in Central America, specifically in agriculture, WASH and hydroelectric sectors, and its effect on the region's and the countries' economies”. In the case of agriculture, the emphasis is on basic grains.

Specific objectives include the assessment of different aspects such as additional costs incurred by operators, the costs to the economy and the financial impact faced by Central American during the 2014 drought.

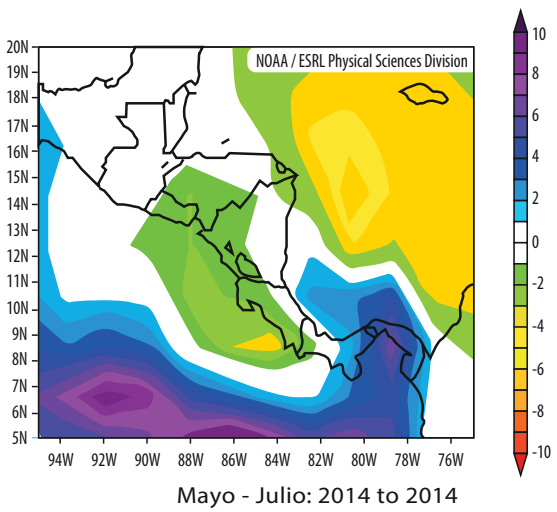
The 2014 Drought

The ENSO phenomenon has negatively affected Central America, bringing with it drought and irregular rainy seasons that have caused economic and social repercussions. In the region, an event involving a deficit in rain linked to El Niño hit the region in 2014 (GWP, 2015).

Between May and July 2014, precipitation fell across the Pacific on average and up to 4 mm per day in some areas. Figure 1 illustrates this trend. Although the scale of the map does not allow for much detail, it is possible to see an overall trend, especially the green area covering from southern Guatemala all the way down to western Panama. The phenomenon affected the entire Central American Dry Corridor and the *"Arco Seco"* of Panama[1]. It also shows that basin conditions along the Caribbean coast remained normal.

FIGURE 1

Map of daily average rainfall in Central America, May-July 2014



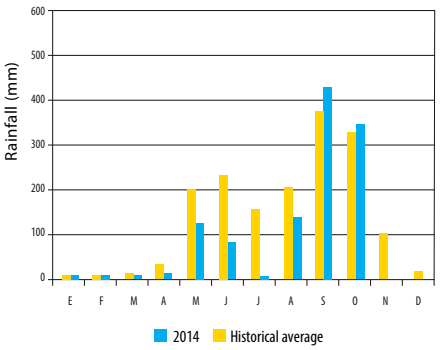
Source: cited by GWP (2015).

1 The term *Dry Corridor* defines a group of ecosystems in the eco-region of dry tropical forests in Central America covering the lowlands of the Pacific coastal area, and most of central pre-mountain region of El Salvador, Guatemala, Honduras, Nicaragua, and parts of Costa Rica and Panama. (FAO, 2012) *"Arco Seco"* of Panama is the coastal zone of the provinces of Cocle, Herrera and Los Santos, which recieves the least amount of rainfal of the country.

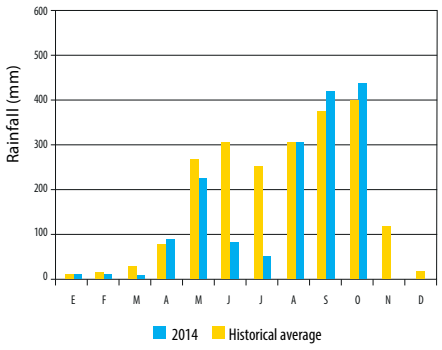
FIGURE 2

Comparison of monthly precipitation in 2014 with the northern Pacific average

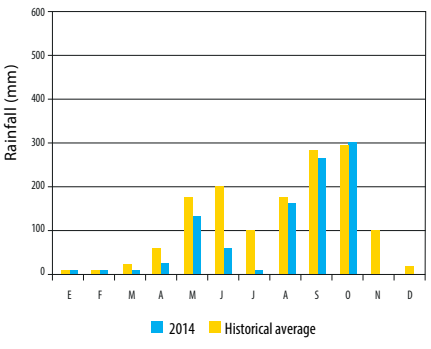
Daniel Oduber Airport, Liberia
Registration period 1975 - 2008
Lat: 10°35´ Long : 85°32´



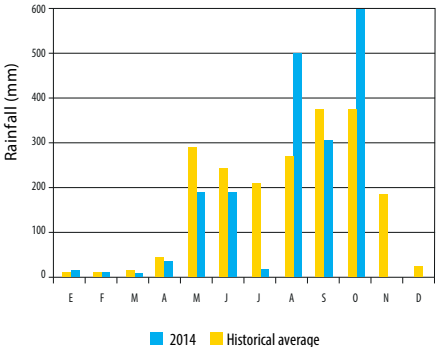
Agricultural Extension Agency, Nicoya
Registration period 1949 - 2008
Lat: 10°08´ Long : 85°27´



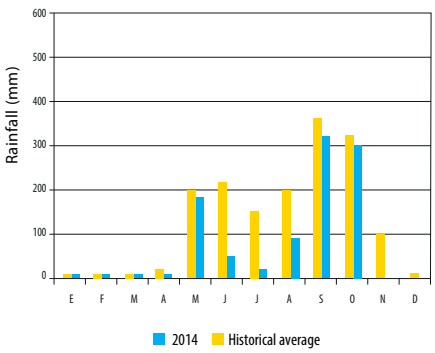
Palo Verde (OET), Bagaces
Registration period 1996 - 2010
Lat: 10°20´ Long : 85°20´



Paquera
Registration period 1974 - 2008
Lat: 09°49´ Long : 84°56´



Santa Rosa National Park
Registration period 1971 - 2008
Lat: 10°50´ Long : 85°37´



Source: Costa Rica National Meteorological Institute. Monthly Meteorological Bulletin, October 2014

By way of example, information is provided on five meteorological stations belonging to Costa Rica's National Meteorological Institute. The comparison shows that in July 2014, precipitation at the Daniel Oduber Airport station went from a historical average of 150 mm to virtually zero. The same trend is seen in all others. The stations in both the Agricultural Extension Agencies in Nicoya and in Paquera report drops of around 200mm in July, and even though in some cases precipitation picks up in August, September and October, for all of them the dry season begins in November when precipitation drops by an average of more than 100 mm. It is safe to assume that this same trend was repeated throughout the region.

In 2014 the problem was not only a precipitation decrease, but a change in the distribution thereof as well. The example above illustrates that while rainfall recovered and was higher than average in August and October at the Paquera station, the damage to economic activities such as agriculture had already been done. This is a sector where one month with no rain can mean crop loss or reduced yields. On the other hand, concentrated rains can cause flooding.

GWP (2015) summarizes the characteristics of this drought:

- Prevalence of dry conditions since the beginning of the year.
- Dozens of dry days in the middle of the rainy season in some cases.
- The *canícula*, which usually takes place in July causing a 2-to-3-week "small summer", lasted up to eight to ten weeks in some countries.
- In some regions, rains were normalized by late September and October, which is very close to the end of the rainy season. This is critical to the agricultural sector, given that some places will not see rain again until May of the following year

Economic importance of sectors

Agriculture

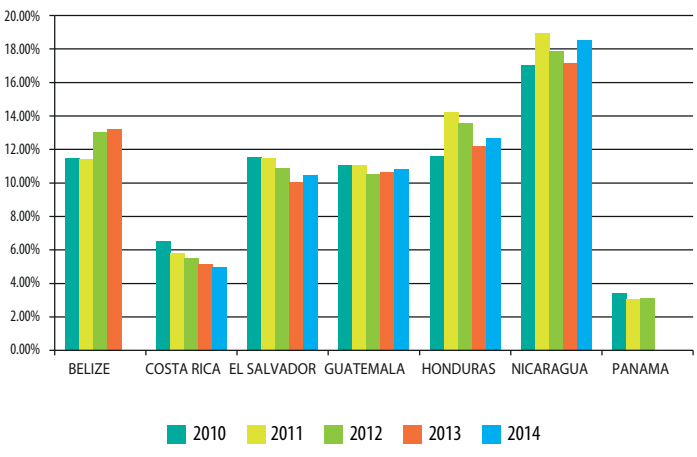
For countries in the region, agriculture is tremendously important from an economic and social perspective.

Figure 3 illustrates the large share in production in all countries of the agriculture sector. In Nicaragua, for example, agriculture accounts for about 20 per cent of the Gross Domestic Product (GDP), while in Belize, El Salvador, Guatemala and Honduras, the sector accounts for 10 per cent. In Costa Rica and Panama this sector accounts for around 5 per cent of GDP, which is by no means negligible.

The agricultural sector is a very important source of employment. In Guatemala, Honduras and Nicaragua, around 35 per cent of the labour force is engaged in agriculture. In El Salvador and Belize, this figure is around 20 per cent, while in Costa Rica and Panama it is 15 per cent (ECLAC 2014). Agriculture is one of the most important sources of employment at the regional level and the main one in rural areas. Furthermore, this is a sector that acts as a 'cushion' for urban employment in the

FIGURE 3

In Central America - agriculture, livestock, hunting, forestry and fishing as % of GDP at current prices in US$



Source: ECLAC. Author, based on official sources.

event of a crisis. Therefore, the percentage of people engaged in agricultural activities is quite higher than the sector's contribution to regional production (EPYPSA 2009).

While there are differences between countries, a large percentage of the population is located in rural areas and is engaged in agricultural work. Considering the rural environment only, the agricultural sector absorbs more than half of the employed rural population throughout the region (54.1 per cent), although its relative importance varies between countries. Its importance is greater in Nicaragua, Honduras, Guatemala and Panama, where it employs more than half of the rural employed population (EPYPSA, 2009).

It is important to remember that in Central America irrigation covers only a small percentage of agricultural production, which makes the region particularly vulnerable to drought (GWP, 2015). Thus, the amount of cultivated areas under irrigation in relation to total area is 18 per cent in Honduras; 25 per cent in Costa Rica; 3.2 per cent in Nicaragua; 4.9 per cent in Panama; and 1.6 per cent in El Salvador (Web GWP).

Moreover, the percentage of population living in poverty and in extreme poverty increases in rural areas (see "The Outlook for Agriculture in Latin America and the Caribbean 2015-2016"), which is almost 50 per cent in some areas.

In 2003, 64 per cent of the poor lived in rural areas. This pattern is repeated in all countries individually. In addition, the incidence of poverty is higher in rural households whose members are engaged in agricultural activities (70.9 per cent). Rural area residents also face basic gaps in areas such as access to safe water and sanitation, education, health care and electricity, among others (Central American Agricultural Council, 2007).

All this points to the region's economic vulnerability in terms of social and food insecurity of the most vulnerable population.

In sum, this means that agriculture is very important for Central American society from various perspectives. It contributes significantly to the generation of added value and production, it is extremely important to nutritional and food security, and represents a source of employment, especially for the people most vulnerable to climate events.

Basic grains

In the region, basic grains continue to be more important to the agricultural sector and rural areas. They are the foundation of the diet of a significant part of the population, in addition to being one of the main sources of income and employment.

For example, maize is one of the main staples of Central America. In addition to being the most widespread crop, in Guatemala, it is one of the most valued and embedded symbols of their culture. This grain has left a mark on the eating habits of the population that still endures to this day. Maize is a central element of Mayan cosmic vision embodied in the Popol Vuh, which maintains that human beings were made out of white and yellow maize varieties (Echeverría, 2009).

In Nicaragua, bean production accounts for more than one 1 per cent of GDP, while in the rest of Central American countries it accounts for barely 0.17 per cent of GDP. Furthermore, Nicaragua is the largest consumer of beans in the region, and this grain is the most important source of protein and iron in diets (see Figure 4).

GWP cites data that highlight the importance of basic grain production in some countries (2015):

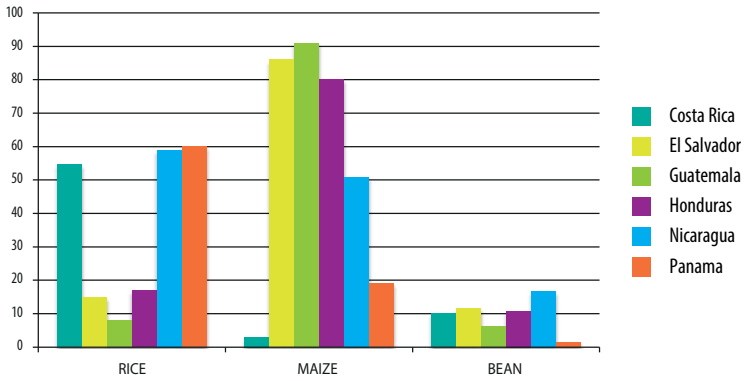
El Salvador: basic grains generate 33.8 million in wages during the agricultural phase, accounting for 26.6 per cent of the total labour demanded by agriculture. Maize alone provides 68 per cent of employment.

Panama: basic grains create sources of employment for 15 per cent of those employed in the agricultural sector.

Guatemala: at the level of small producers, basic grains generate approximately 60 per cent of all jobs. Nationwide, maize accounts for 73.4 per cent of the employment generated by basic grains.

FIGURA 4

Consumption of basic grains in Central America (Kg/capita/year) - 2005



Source: Author, developed from FAO (2009) and CONARROZ (2010) data

The value of agricultural production that corresponds to basic grain production in Central America is considerable. In 2011, maize, beans and rice generated an added value of US$ 976 million in Guatemala, US$ 469 million in El Salvador, US$ 303 million in Nicaragua, US$ 242 million in Honduras, US$ 75 million in Panama, and US$ 67 million in Costa Rica (SIAGRO, 2013).

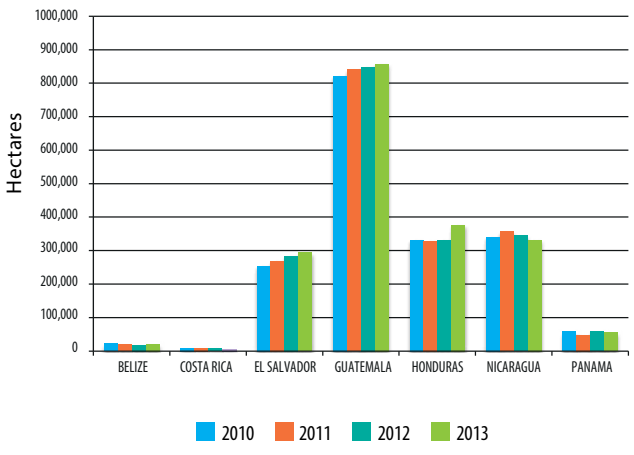
Even so, Central America is still not self-sufficient in any of these to meet domestic consumption, with the exception of Nicaragua, which produces all the beans it consumes. As for maize, more than 50 per cent of that which is consumed is imported, which has led to dependence on imports and to becoming vulnerable to rising product prices. The main supplier of maize in Central America is the United States (GWP, 2014).

There are significant differences between countries in terms of area dedicated to maize production (see Figure 5). Guatemala is by far the largest producer, while production in Costa Rica and Belize is minimal. In terms of productivity based on production per area used, Honduras is the most productive with an average close to 5.0 tons/hectare. Cultivated areas show practically the same behaviour as in the figure mentioned.

More than 600 thousand hectares of beans are harvested per year in Central America. Nicaragua is the country with the greatest amount of cultivated area and the biggest bean producer in the region (35 per cent of the total for Central America). Bean production is much lower in Costa Rica and Panama (see Figure 6), while in Nicaragua beans accounted for 33.28 per cent of the entire basic grain production in the country for the 2005-2006 cycle (EPYPSA, 2009).

FIGURE 5

Area dedicated to maize production in Central America

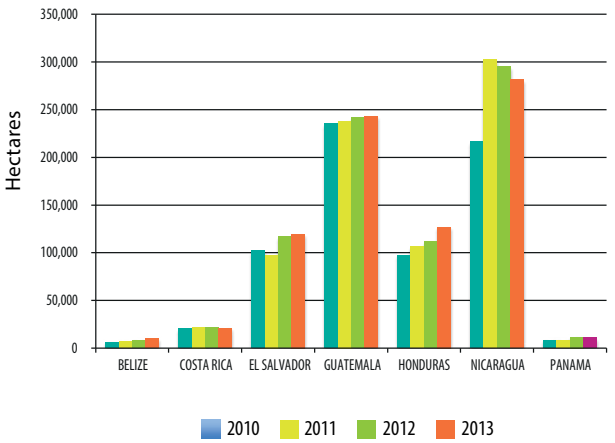


Source: Author, based on FAOSTAT data

"In the region, basic grains continue to be more important to the agricultural sector and rural areas. They are the foundation of the diet of a significant part of the population, in addition to being one of the main sources of income and employment."

FIGURE 6

Area dedicated to bean production in Central America



Source: Author, based on FAOSTAT data

Hydropower

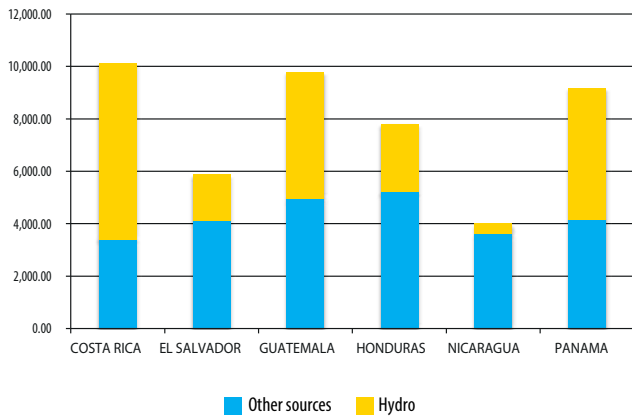
The main electricity-generating source in Central America is hydropower, which relies on accumulation of rain water to operate.

Hydroelectricty is the oldest form of energy generation in Central America, where the first plants were installed in the late 19th century; however, its dominance in the region's energy mix is gradually decreasing as the use of other renewable resources and fossil fuels increases. (Dolezal et al, 2013).

Large-scale hydropower can be one of the least expensive sources of electricity when the entire lifecycle is taken into account. After relatively high initial costs (mainly involving the construction of dams and reservoirs), hydroelectricity has fewer recurrent costs than fossil fuel-based energy. It is a reliable source of base load power which can be increased or decreased on demand and supplements renewable energy sources such as wind and solar. (Dolezal et al, 2013). It allows reducing dependence on non-renewable energy sources, which in addition generate imbalances in the trade balances of Central American countries because they have to be imported.

FIGURE 7

Total and hydroelectricity generation in 2014 (GWh)



Source: ECLAC 2015

For example, research indicates that the production cost for hydroelectricity is between US$ 0.05 and US$0.07 per kWh. When generated by fossil fuels, the cost rises up to US$ 0.23 per kWh, which is three times more; and can cost up to US$ 1.00 per kWh when generated via more inefficient gas-run plants in the region.

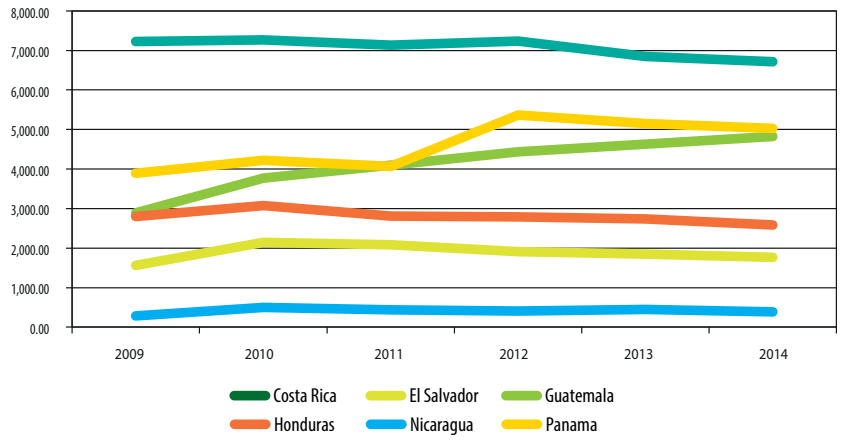
When considering CO_2 emissions for each energy source, hydroelectricity also generates environmental benefits. While hydroelectricity emits 17 tonnes of CO_2 to produce one GWh (gigawatt-hour), diesel and bunker generate some 600 tonnes depending on the technology. Even combined-cycle natural gas, which is more efficient, generates 350 tonnes per GWh, i.e. about 20 times more than hydropower.

Based on the information above and assuming that the average cost of electricity for the end user is US$0.20/kWh, electricity generation through hydro power in the region is worth more than US$ 4,200 million per year (see Table 1).

Costa Rica is where the highest estimated revenue is generated, followed by Guatemala and Panama. Even in Nicaragua, which is where the least amount of hydro power is generated, the market is more than US$ 75 million per year, not an insignificant figure.

FIGURE 8

Hydroelectricity generation, in GWh



Source: ECLAC 2015.

TABLE 1

Estimated revenue from the sale of hydroelectric power

Country	Revenue in US$ (at $0,20/kWh)
Costa Rica	1.343.440.000
El Salvador	353.740.000
Guatemala	964.740.000
Honduras	517.720.000
Nicaragua	77.820.000
Panama	1.004.640.000
TOTAL	4.262.100.000

Source: Author, based on ECLAC data (2015).

"... assuming that the average cost of electricity for the end user is US$ 0.20/kWh, electricity generation through hydro power in the region is worth more than US$ 4,200 million per year."

WASH

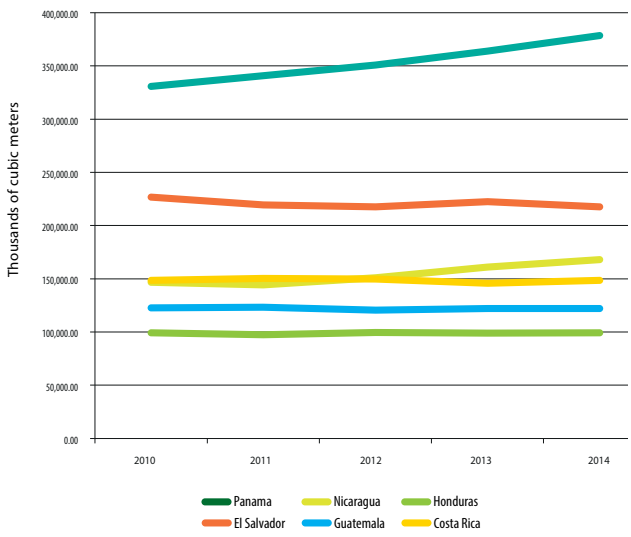
The WASH sector is a source of multiple benefits to society in terms of health, hygiene and quality of life.

The 'production', distribution and consumption of water is a social benefit far greater than production costs, and the price itself because of how connected water is to health, hygiene and other facets of daily life. According to WHO (2004), drought is a cause of bad health and disease because it triggers and exacerbates malnutrition and hunger while hindering adequate water supply - 88 per cent of diarrhoeal diseases are the result of unsafe water use and inadequate sanitation and hygiene. Improving water supply reduces the incidence of diarrhoea by between 6 and 21 per cent.

Based on the above, the benefits of access to safe water far exceed the price charged for it. Even so, a good starting point for gauging its importance in economic terms is the total value of water billed by the various water service operators in Central America. These operators mainly include State-owned companies (EMPAGUA in Guatemala, AyA in Costa Rica, ANDA in El Salvador, SANAA in Honduras, IDAAN in Panama, and ENACAL in Nicaragua), but also a variety of actors: municipalities, ministries, local associations and others.

FIGURE 9

Total water services billed, by country (thousands of cubic metres)



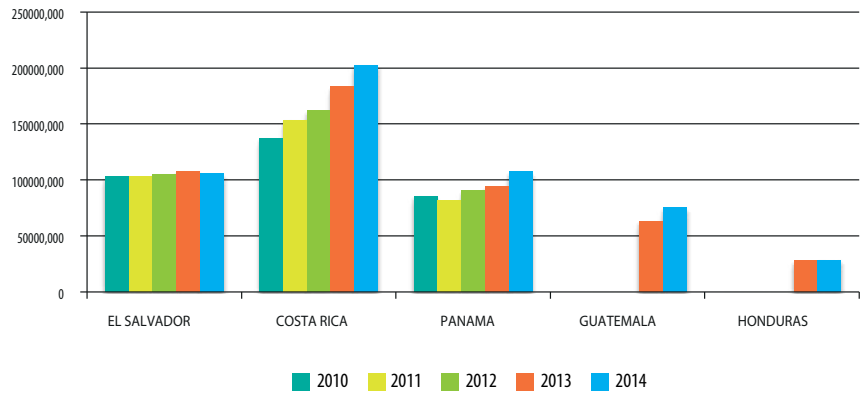
Source: Author, based on data from: Central Bank of Nicaragua; Central Bank of Honduras (selected cities: Central District, San Pedro Sula and Puerto Cortes); 2014 and 2013 Statistical Bulletins; National Aqueduct and Sewer Administration, ANDA, El Salvador; EMPAGUA- INE, Guatemala; Comptroller General in Panama; and ARESEP, Costa Rica.

According to official statistics, water distribution by companies is a business of at least US$ 500 million in the region (see Figure 10), possibly generating considerably more. The information regarding billed revenues shows some inconsistencies that need to be pointed out, since it can lead to some misinterpretation. For example, it would seem that compared to other countries Honduras is a small market; however, the difference is that a large part of the population gets their water from their own sources, so part of the water goes unbilled. Moreover, the unit price is low.

> *"The 'production', distribution and consumption of water is a social benefit far greater than production costs, and the price itself because of how connected water is to health, hygiene and other facets of daily life."*

FIGURE 10

Billing from water sales (in millions of US$)



Fuente: Author, based on: 2014 and 2013 Statistical Bulletins, National Aqueduct and Sewer Administration, ANDA, El Salvador; EMPAGUA- INE, Guatemala; Comptroller General in Panama; SANAA, Honduras; y ARESEP-Costa Rica

TABLE 2

Service providers by country, and population served

Country	Company	% Population served
Costa Rica	AYA y ESPH	51% y 0,5%
El Salvador	ANDA	94%
Guatemala	EMPAGUA y EMAPET	10% y 0,005%
Honduras	SANAA	20%
Nicaragua	ENACAL	52%
Panama	IDAAN	66%
TOTAL	4.262.100.000	

Source: Corton, María Luisa, et al (2007).

1 Sometimes statistics do not include revenue from municipalities, ministries and other providers

Economic impact of drought, by sector


Photo: Andrea Pacheco

Climate determines the outcomes of economic activities in all three sectors considered. Agriculture, hydroelectricity and WASH are negatively affected by reductions in rainfall for many reasons.

The amount of expected rainfall and its distribution in time is a critical factor that must be taken into account when making production-related decisions: how much to produce, what to produce, and how to produce it.

Each sector responds differently to drought. Of the three sectors analysed, the most sensitive is the agricultural sector, as it depends directly on rain. In this sector, the smaller producers are usually the most vulnerable because they do not have irrigation systems. On the contrary, since the hydropower sector is based on water stored in reservoirs, it is inherently resilient to changes in the amount and distribution of rainfall; in fact, that is precisely its purpose - regulating water flow. Finally, as for WASH in the Central American region, most water for human consumption is obtained from wells, which respond at a later stage to changes in rainfall, since aquifers act as water reservoirs.

Because of the structural differences in each sector and how these relate to rain, drought manifests itself in different ways from a socio-economic perspective, as summarized in Table 3. Drought always results in decreased quality of life and human development.

TABLE 3

Types of economic losses associated with drought, by sector

Sector	Economic loss
Agriculture	• Production loss. An event can mean the loss of entire harvests depending on the stage and degree of the crops' development. This can also result in loss of sources of employment and for self-sufficiency, affecting food security. • Reduced productivity. Non-optimal conditions can reduce production per unit of effort. The entire harvest is not lost, but it is reduced. • Reduced supply of agricultural products, resulting in higher prices at the local level. This, combined with the above, diminishes the most vulnerable populations' ability to access food, creating food insecurity and child malnutrition. • Reduced opportunities. School dropout in rural areas, deterioration in public health indicators, loss of seed and difficulty working the land.
WASH	• Increased extraction costs due to decreased water levels, which involves increased energy expenditure. This affects the finances of service providing institutions. • Some cases require tanker trucks to deliver water to homes, thus increasing distribution costs. • Water rationing affects the population and economic activities such as trade and others. • Increased potential for illegal exploitation of wells. • Increased treatment costs due to a decrease in water quality.
Hidropower	• Replacing hydroelectricity for fossil fuel-based power increases electricity production costs. • A country's loss of competitiveness due to increased production costs. • Increased carbon emissions. A plant running on fossil fuels may generate up to 20 times more emissions. • Rationing: it is estimated that each kilowatt not delivered to the economy due to energy rationing may cost up to US$ 3.

Estimating the economic effects of climate changes (such as drought) in each of these three sectors is a complex task because of the large number of variables that determine the performance of the economy. While economic activities are conditioned by climate in many ways, especially in sectors such as agriculture, water management and hydroelectricity generation, there are also many other factors that determine the benefits.

The information and data required are not always available. It is not easy to isolate the economic impact of drought because the profitability of any given economic activity is determined by many factors, some even of an external nature. Data generally used relates to what it costs the government to compensate affected sectors, the total value of crops and other measurements. For example, the Panama Canal was forced to limit the passage of ships due to the drought, which has a considerable economic impact.

Agriculture

Hydro-meteorological phenomena affect the agricultural sector in particular: around 60 per cent of the economic damages from drought affect this sector.

In the case of hurricanes, although in relative terms the damages are not so concentrated in this sector, the damage is higher in absolute terms (Jiménez, 2007), (Echeverría, 2009).

As expressed above, the importance of production from the cultivation of basic grains in Central America lies in that they are the foundation of the populations' diet, their importance is greater among the poorest, and they constitute the main source of income for many families. In some countries they are also an important component of domestic production and exports. Furthermore, maize and beans have a great cultural and economic significance in Mesoamerica (GWP, 2014).

Drought has historically affected Central America. For example, the El Niño phenomenon in 2009 led to the loss of 30 per cent of second-season maize harvests in Nicaragua and Costa Rica, causing losses in the order of US$ 6.25 million, especially affecting 1,200 hectares of rice (Central America Data), (Echeverría, 2009). The region has lost US$ 9,800 million to drought in the past 30 years, and more than 50 per cent of these losses correspond to the agricultural sector. This vulnerability has a very strong impact on GDP, which is why this issue in high up in the political agenda (Ramírez, 2007), (Echeverría, 2009).

Effect of precipitation on maize and bean productivity: Costa Rica and El Salvador

A study by Caballero (2004) estimated the effect that precipitation may have on maize and bean productivity in Costa Rica and El Salvador. This is useful, as sometimes the entire crop is not lost, but changes in productivity occur. This study estimates the average value of precipitation and how it varies when it increases or drops by 100mm.

TABLE 4

Contribution of precipitation per tonne of product in US$

Country	Average Contribution	-100 mm	+100 mm
Costa Rica			
• Maize	14,22	12,33	16.1
• Bean	106,33	92,25	120,41
El Salvador			
• Maize	19,2	15,54	22,85
• Bean	87,89	71,15	104,63

Press and summary of news items[2]

Below is a summary of the impacts of the 2014 drought, by country, reported in various media.

Costa Rica

- The most affected areas are the North Pacific, Central Pacific and South Pacific regions of Costa Rica, which produce the greatest amount of basic grains and livestock in the country.
- Losses are around US$ 13 million in the basic grain production sector and US$ 6.5 million in the livestock sector. Ministry of Agriculture and Livestock (MAG) reported that 2,118 hectares of crops have been lost, and 11,718 others have been affected in varying degrees.
- 30,128 tonnes in agricultural products have been lost, in addition to 8,312 tonnes of milk, meat and honey. Drinking water shortages have also been reported. The most affected crop is maize, with 1,378 hectares lost, followed by 604 hectares of rice, 57 hectares of watermelon, 50 hectares of sugar cane and 29 hectares of bean. The drought has reduced meat production by 5,814 tonnes, meat by 2,496 tonnes and honey by 2.4 tonnes.
- The Government announces a ¢27,000 million investment in Guanacaste to mitigate the drought's impact.

2 This is a summary of the news. See the Annex for more details, including date of publication.

El Salvador

- Crop damage from drought amounts to US$ 85 million. 8 million quintal s of basic grains were lost from an area of 165,000 *manzanas*[1]. The Central American Federation of Chambers of Agriculture and Agroindustry (FECAGRO) estimated that 30 per cent of the territory suffered damages due to the lack of rain. In the case of El Salvador, 45,000 *quintales*[2] of beans were lost out of a total of 4 million *quintales* of grains lost.
- The country will import 9,000 tonnes of duty-free red beans (approximately 200,000 quintals) from Mexico and Colombia to deal with the wave of "price speculation" that caused the price to rise from US$ 60 to US$ 100/*quintal*.
- The Government will allocate US$ 15 million toward the recovery of basic grain production in eastern areas, which consists of distributing 200,000 packs of bean seed and 15,000 packs of maize and sorghum seed.
- Loss of 3.4 million *quintales* of maize and 2,700 *manzanas* of bean. Estimated cost: US$ 500,000.
- US$ 500.000 for a contingency plan for the livestock sector.
- MAG invested US$ 20,224,000 in maize seed and fertilizer.
- MAG approved the import of 470 tonnes of bean, approximately 20,141 *quintales*. The price for beans of the seda variety reached US$ 115/quintal and US$ 106/quintal for the tinto variety.
- The Agriculture and Livestock Development Bank (BFA) reported US$ 8.2 million in losses due to the drought. That US$ 8.2 million are being condoned as part of the Agricultural Guarantee Programme (PROGARA) that operates with funding from the Development Bank of El Salvador (BANDESAL). BFA granted 21,394 loans to plant 77,000 *manzanas* of beans, maize, rice and sorghum. Of these, 8,501 were affected by the meteorological event. The land affected amounts to 18,361 *manzanas* (23.7 per cent).
- Black bean sales quadruple. GUMARSAL sold 1,700 *quintales* in August and 1,300 more *quintales* in July (2014); however, red bean prices have reached between US$ 1.15 and US$ 1.50 per pound, while the pound of black bean sold for US$ 0.75. El Salvador has suffered a drought that has led to the loss of more than 9 million *quintales* of grain. GUMARSAL said that the price per pound of red bean would stall below the US$1 mark thanks to 100 containers of grain being imported from Ethiopia.
- The drought in July caused US$ 70 million in losses; by August this figure is expected to reach US$ 82 million.
- More than 9 million *quintales* have been lost. 250,000 direct and indirect jobs have been lost.
- 3.7 million *quintales* of white maize and 55,000 *quintales* of bean were never planted, affecting 102,000 households that depended on agriculture.
- The price of beans in the San Salvador Metropolitan Area continues to rise, although prices vary between departments. In Gerardo Barrios Street, the seda variety of red bean sells for US$ 1.50/pound, which in the markets of Santa Tecla and San Marcos sells for between US$1.40 and US$ 1.50. In San Salvador the price per *quintal* ranges between US$ 122 and US$ 130.

Guatemala

- People affected by drought will receive maize, beans and flour for 6 months. 45.2 kg of maize, 13.5 kg of beans and 7.9 kg of fortified atol were distributed across 7 locations. Estimated cost: US$ 10.8 million.
- US$ 900,000 will be donated to families affected by drought. Estimated cost: US$ 900,000.
- The Government announced it needs 500 million *quetzales* to respond to 236,000 families. Estimated cost: US$ 65 million.
- Drought affects 1.2 million people from 3,571 communities in 210 municipalities. 266,000 families affected. Loss of between 5 and 6 per cent of crops. 80 per cent of maize crops and 63 per cent of bean crops have been lost. Loss of 1.89 million *quintales* of maize, which accounts for 4.7 per cent; and 661,000 *quintales* of bean, which accounts for 26 per cent of domestic production. Estimated cost: US$ 57 million.

Honduras

- The drought has severely hit 10 departments and 64 municipalities in southern areas of the country, including 76,712 small producer families: 37,131 maize producers, 14,075 bean producers and 25,506 sorghum producers.
- Bean price increases of up to 132 per cent.
- 4,221,301 *quintales* of maize and 229,346 *quintales* of bean have been lost.
- The Government will open a US$ 71-million trust in view of the losses caused by the drought. 76,000 families affected by drought have been served.
- The Government aims to assist 76,000 families affected by the drought's severity. The Government is conducting financing efforts to secure US$ 150 million from abroad aimed at driving irrigation programmes. It will promote the irrigation of some 50,000 hectares, at a rate of 6,500 hectares per year. Of 400,000 hectares in production, 150,000 hectares are operating under irrigation systems.

1 1 manzana = 0,70 hectares
2 1 quintal = 100 pounds

- According to reports, rain shortages have devastated 70 per cent of maize crops and 45 per cent of bean crops.
- The Government is seeking international cooperation to cope with the drought. Under the right to humanitarian assistance, it has requested between US$ 27 and US$ 30 million to continue to respond to the more than 112 municipalities, plus 55 others that have requested support.
- Food security plan for drought, 10 municipalities for the construction of water harvesting works, participatory early warning system, climate change strategy for the agricultural sector.
- The U.S. Government will allocate US$ 3.9 million to support food security in Honduras, especially programmes targeted at people affected by drought and coffee rust. In addition, the United States allocated US$ 190,000 to support some of the communities most affected by drought in the departments of Lempira, Intibucá and La Paz. Within the framework of the Dry Corridor Alliance, the U.S. Government contributed US$ 35 million to lift 50,000 families out of poverty.
- The Government of Taiwan donated 3.1 million lempiras to the Honduran Government to implement the Food Security Plan of Action for Drought. This will help improve and ensure food and nutritional security for dozens of families in the interior of the country. Some 76,000 families living in the Dry Corridor were affected by drought.

Nicaragua

- Greater impact to the Dry Corridor, comprising 68 municipalities, the most affected.
- In 32 municipalities, of a 60,600-*manzana* area dedicated to maize cultivation, 41,000 *manzanas* were lost. As for bean, of a 37,574-*manzana* area, 26,073 *manzanas* have been lost, affecting 40,000 families.
- At the national level, 57,000 of 275,000 *manzanas* of maize have been lost. In the case of beans, 31,000 of the 100,000 *manzanas* planted have been lost completely.
- Maize production for the 2013-2014 cycle is estimated at 8.3 million quintals, 11.7 per cent less than the previous cycle.
- 2,500 head of cattle have died from lack of water.
- Currently, 600,000 head of cattle are facing grass or forage shortages.
- One pound of beans is selling for C$ 33 in Estelí. Some consumers have no problem switching from red to black beans when the first becomes scarce or increases in price (to between C$ 31 and C$ 33 per pound), although clearly there are families whose incomes do not allow them to buy red beans at that price. The price difference between black and red beans can be up to C$ 18 or C$ 20.
- The price being paid to small and medium-sized producers by dairy product processors fell by 4 or 5 córdobas, from 38 córdobas per gallon. Milk producers not affiliated to cooperatives are being paid between 28 and 32 córdobas per gallon. Variations in fat percentages when buying the milk is also affecting the price per gallon. These are the consequences of unwatered pastures.
- According to the Nicaraguan Federation of Livestock Associations (FAGANIC), there are one million malnourished cattle in the country's dry zone. This has two types of repercussions: on livestock reproduction and on employment generation. The Government's proposed solutions: facilitating transport of food by-products and a US$ 300,000 fund.
- Food shortages and rising red bean prices worried coffee growers. The pound of red beans at the time sold for C$ 30 and black beans sold for C$15. The daily ration of beans and maize per person is half a pound and one pound respectively. It is estimated that in Jinotega 2,700 quintals of beans, 5,500 quintals of maize and 700 quintals of rice per day are required to supply 55,000 coffee pickers.

Panama

- Rice cultivation and harvest are down this year. Production has been reduced by 50 per cent, while at the same time experiencing a reduction in producers as well. In 2013-2014, the cost of planting one hectare of rice in Chiriquí was US$ 2,160, which rose to US$ 2,200.

> *“Drought always results in decreased quality of life and human development.”*

Cost of the 2014 drought for the sector

In basic grains, and agriculture in general, productivity is related to factors that directly influence production systems (Fuentes et al, 2005). These factors include climate, soil, water, time of sowing, land tenure, use of labour, use of inputs, sale price at harvest, and irrigation costs.

The 2014 drought had a significant impact on maize and bean production. Losses can be divided into two major groups: loss of harvest and reduced productivity. Sain (2015) estimates percentage losses in maize and bean productivity as the difference between yields in 2014 and the averages for 2012 and 2013 in Guatemala. Perceived losses represent the producers' answers when asked to provide an estimate of the losses in 2014, while estimates were calculated as the difference between yields obtained in 2014 and the averages for 2012 and 2013 (see Table 5).

TABLE 5

Percentage loss perceived and estimated from the 2014 drought

Crop	Perceived loss in %	Estimated loss in %
Bean	30	27
Maize	83	83

Source: Sain, Gustavo. 2015. Analysis of the impact of the introduction of ASAC practices in eight municipalities in Guatemala.

The loss for each country can be estimated using the perceived loss information in the table above and the production cost. The replacement cost, i.e. what it would cost to replace what was lost due to the drought, is approached through production costs. This measurement is useful, as it provides a lower bound for loss incurred by producers. It is a lower bound because the loss will be greater as the crop progresses in time (for example, if harvest was almost ready and then lost).

TABLE 6

Production costs in US$/hectare

Country	Maize	Bean
Costa Rica	620	441
El Salvador	842	560
Guatemala	465	342
Honduras	198	248
Nicaragua	200	119
Panama	465	342

Source: Own development based on information provided by Ministries of Agriculture in countries and IICA.
Note: The regional average is used for Guatemala and Panama.

Based on production cost information provided above, and conservatively assuming a loss of 25 per cent of the bean harvest and 50 per cent of maize production, it is possible to estimate the loss for the sector. Note the significant extent of the costs generated by the drought, especially in the case of maize for Guatemala and El Salvador (see Table 7).

TABLE 7

Estimated value of loss, by crop and country (US$)

Country	Maize	Bean
Costa Rica	1.939.050	2.284.821
El Salvador	123.853.569	16.783.620
Guatemala	199.401.300	20.779.920
Honduras	37.323.000	7.874.000
Nicaragua	33.182.900	8.381.646
Panamá	12.957.225	949.050

Source: Author

Hydropower

If rainfall is low, there is less hydroelectric generation, which can lead to energy crises in countries highly dependent on hydropower.

For example, in 2007 Costa Rica declared a national emergency when it experienced constant blackouts during the summer due to a shortfall in power supply. Electricity production in Costa Rica is mainly hydroelectric. El Niño effects caused a drier summer, which in turn caused a water deficit in reservoirs (EPYSA, 2009).

Replacing this energy with alternative energy production, such as thermal power from fossil fuels, may cause an increase in production costs and, therefore, a loss of competitiveness for the country. It may also cause an increase in the carbon footprint because of the amount of GHG emitted nationwide.

According to GWP (2015), electricity supply measures during the 2014 drought included, in the case of El Salvador and Costa Rica, an increase in power generation from thermal plants. This resulted in having to import fossil fuels, higher costs and the production of CO_2 emissions. It must be noted that the 2014 drought occurred precisely between June and September, the most critical months for hydroelectric production.

In the case of Guatemala, there was a period in June with significant rains, as well as in the period from October to November. This allowed recovering and exceeding the previous volume stored at the Chixoy dam, which prevented the institution from suffering an economic impact.

In the case of El Salvador, the regions where the main reservoirs are located went without rain for 49 consecutive days. This resulted in restricted electricity generation. The Lempa River experienced an 87 per cent reduction in flow, while the flow of the Torola River suffered a 90 per cent reduction in August alone. SIGET and CEL reported that at the peak of the impact only 10 to 15 per cent of the demand was met despite the projections that spoke of 25 to 40 per cent. The rest was generated by privately-owned thermal plants.

Rationing became necessary in Honduras, given that the precipitation deficit reached 50 per cent; however, the storage capacity for generation was recovered once the rainy season started.

For Costa Rica, the generation of hydroelectric power was less than projected, forcing it to use fossil fuels for longer than expected, which increased the cost of the service. Even so, service was neither suspended nor rationed, and the shortfall was offset with increased thermal production and the power imported between August and early October.

As for Panama, decisions taken as a result of an energy crisis stemming from a drought in 2013 reduced the impact that the 2014 drought might have caused. Power rationing was implemented and State institutions reduced their work hours, which allowed conserving reservoir reserves. It also resorted to thermal plant generation.

Summary of news items regarding the hydroelectric sector

Costa Rica

- The drought suffered by Costa Rica triggered alerts regarding the use of hydroelectric dams. Water reserves are being used moderately, said the Costa Rican Electricity Institute (ICE). The lack of rainfall in the country affects watershed areas where hydroelectric plants are located. Using the Arenal reservoir (in northeaster Costa Rica) as a reserve has been fundamental to solving situations such as these.
- The generation of electricity at CoopeGuanacaste is down 10 per cent.

El Salvador

- Hydroelectric production: a 2 per cent shortfall is expected, as well as a 15 per cent drop in the volume stored in the main reservoirs (Cerrón Grande and Guajoyo).
- According to data from the State's National Energy Council (CNE), to 27 July 2014 electricity generated from water (hydroelectric) has gone down in relation to the previous year's patterns. One of the main hydroelectric power generators in the country, the 15 de Septiembre plant, has reduced power generation by more than 51 per cent. In July 2013, this plant generated an average of 2,119.7 megawatts (MW h) per day; however, by July of this year generation has been almost halved, producing an average of 1,034.4 MW h per day.
- The Cerrón Grande plant is experiencing another factor besides a reduction in power generation, and that is that reservoir levels have dropped. In this case, energy production decreased by 15.1 per cent.

Honduras

- In view of the decline in energy production from water sources, there must be more thermal generation and import.
- Chamber of Commerce in Tocoa, Colón: no electricity for eight hours a day. The losses caused by these energy issues are unquantifiable.[3]

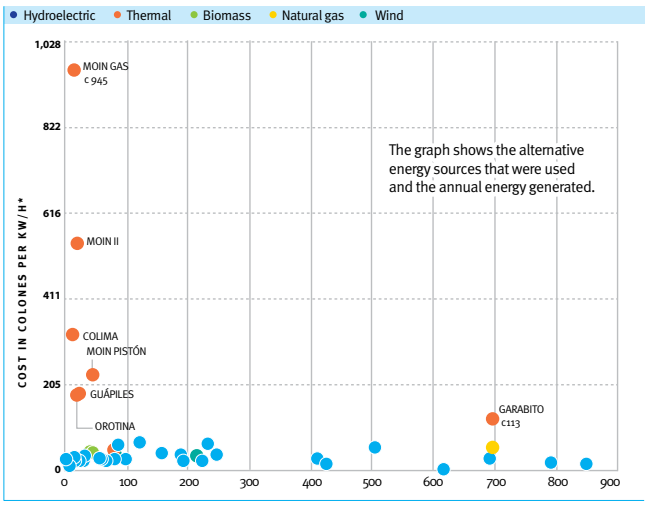
Cost of the 2014 drought for the sector

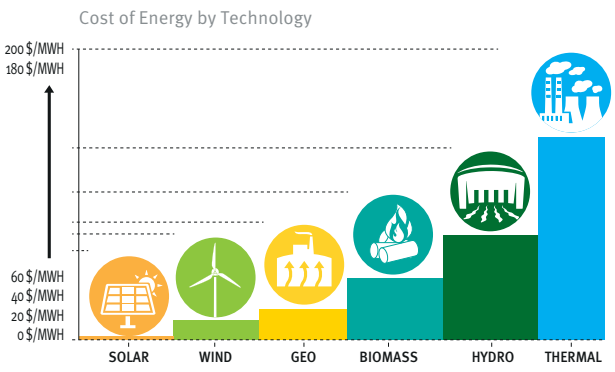
For this estimate, the assumption is made that power which failed to be generated due to drought was replaced with fossil fuels (a reasonable assumption). Furthermore, the reduction in hydroelectric generation in 2014 in relation to the 2010-2013 average was due precisely to drought. For the difference in cost, US$ 0.29 per kWh is used for generation from fossil sources and US$ 0.07 for hydroelectric generation (based on information from ICE, Costa Rica).[4]

FIGURE 11

Cost of electricity production from various sources

Data from 2012 show the remarkable difference between the cost of generating electricity from ICE thermal plants and the cost per kilowatt hour (kWh) generated from other sources. The figure also includes the difference in the amount of energy produced by each plant in a year.





3 It must be noted that in this case the problem is not necessarily due to drought, since this area has problems with its electrical infrastructure.

4 This is very conservative, since there are thermal plants which generate at a far greater cost.

The results are shown in Table 8, and present the cost of replacing hydropower with fossil energy in US$ as per the previous assumptions. The first column shows the hydroelectric generation average between 2009 and 2013, while the second column shows production in 2014. The third column shows the difference, and represents the reduction in hydroelectric generation. It is assumed that it is replaced with fossil energy, which has an additional cost of US$ 0.22 per kWh, the results for which are shown in the fourth column. Guatemala and Panama experienced circumstances that were not related to the 2014 drought, which instead resulted in greater generation, so this calculation is not applied to these countries. Once the reduction is estimated, the US$ 0.22 differential is applied (this is the difference between hydraulic power generation and fossil fuel-based generation). This is how the incremental cost of providing energy, which can be attributed to the 2014 drought, arrives at a total of $186 million. This number is very important, as it accounts for nearly 5 per cent of the total value of electricity sales in 2014 (see Table 1).

This is considered a very reasonable and conservative estimate, since the costs of climate change in hydroelectricity production associated with changes in precipitation patterns could represent 8.93 per cent and 19.65 per cent of its current value (Caballero, 2004). Clearly, this will depend on the dam's location (Caribbean or Pacific) and the magnitude of the event. In this case, the 5 per cent result is consistent and rather conservative.

However, in addition to the extra financial cost, which is ultimately assumed by the end user, there is also the economic cost to society as a whole. This includes, for example, additional CO_2 emissions from thermal generation. As mentioned before, thermal generation can generate up to 40 times more emissions than hydraulic generation. To achieve a conservative estimate, it is assumed here that emissions are 20-fold: 17 tonnes of CO_2 per GWh for hydro and 350 for fossil (see Table 9.); i.e. 343 additional tonnes of CO_2 are emitted for every GWh which has to be produced with fossil fuel

TABLE 9

Emission index by technology

Technology	Tonnes of CO_2 equivalents/GWh
Hydroelectric	17
Wind	1
Geothermal	90
Open cycle gas turbine	600
Medium-speed engine with bunker	600
Combined cycle with natural gas	350
	186.010.000

Source: Author, based on data published in the 2011 Energy Expansion Plan by the Costa Rican Electricity Institute.

TABLE 8

Change in hydroelectric generation and cost of replacement

	Average 2009-2013 in GWh/year	Generation 2014 GWh/year	Reduction in GWh/ year	Cost of replacement (US$)
Costa Rica	7.141,00	6.717,20	423,80	93.236.000
El Salvador	1.908,78	1.768,70	140,08	30.817.600
Guatemala	3.964,20	4.823,70	na	na
Honduras	2.841,92	2.588,60	253,32	55.730.400
Nicaragua	417,40	389,10	28,30	6.226.000
Panama	4.541,86	5.023,20	na	na
				186.010.000

Note: Guatemala and Panama experienced circumstances that were unrelated to the 2014 drought, which instead resulted in greater generation, so this calculation is not done

Based on the above information, it is estimated that the 2014 drought caused 281,000 additional tonnes of CO2 equivalents to be released into the atmosphere (see Table 10). This is the outcome of replacing hydroelectric power with thermal energy (fossil). If a US$ 10 price tag were to be applied to each tonne to estimate damage, the magnitude of the impact would be US$ 2.8 million.

The Economic Commission for Latin America and the Caribbean (ECLAC), for instance, estimated the externalities of fossil fuel-based electricity generation in Central America, applying various scenarios. Resulting health costs from local pollution would increase the cost of electricity by between 1.8 and a 5.4 per cent, or an average of US$ 0.14 per kWh (Dolezal et al, 2013).

"ECLAC also analysed the externalities for power in Central America and the Caribbean between 2010 and 2023. It discovered that annual average climate-related costs amount to US$ 307 million, and annual average health-related costs amount to US$ 44 million. Upon applying these results to the energy expansion scenario used in the Central American Sustainable Energy Strategy to 2020, the study found that health- and climate change-related externalities would increase actual costs for fossil fuel-based generating plants by between 8 and 10.6 per cent by 2020" (Dolezal et al, 2013).

TABLE 10

Emission of additional CO2 equivalents caused by the 2014 drought

	Additional tonnes of CO2
Costa Rica	141.125
El Salvador	46.647
Honduras	84.356
Nicaragua	9.424
	281.552

Cost of kWh from fossil fuels (extract from Flavin et al, 2014)

All energy-producing technologies cause an impact on the environment, and one of the main advantages of renewable energy is the ability to mitigate much of that impact. Thermal production plants are a major contributor to local air pollution and responsible for some 7 million premature deaths each year. They also constitute the main source of greenhouse gas emissions, which are expected to rise rapidly in the coming decades, with much of that growth occurring in developing countries. In contrast, the majority of renewable technologies produce negligible emissions, which are quickly offset due to reductions in pollution from fossil fuels. Water consumption also tends to be much less.

Despite direct and indirect subsidies that artificially reduce fossil generation costs, renewable technologies are already competitive compared with conventional fossil fuel-based sources. In 2013, consumers in ten Latin American cities paid an average of US$ 0.28 per kWh or more, compared with the cost of solar and wind, which was US$ 0.10 and US$ 0.07 respectively.

Photo: CC by Daniel Rey on Flickr

WASH

As identified by GWP (2015), there are various costs associated with drought in the WASH sector that make integrated water resource management difficult:

- Service rationing. Can cause cessation of economic activities, as well as effects on society's health.
- Increased extraction costs. An increase in energy consumption from pumping the resource is the outcome of the drop in aquifer groundwater levels.
- Costs for moving or distributing the resource because drought-affected sources are no longer in operation.
- Increased costs from increased use of water purification chemicals due to the deterioration in water quality.
- More intensive exploitation of important aquifers, as well as illegal drilling of wells, affecting efficient water resource management.
- Surface sources diminish or dry up altogether, affecting the population's access to water.

Effects documented (by GWP, 2015) from the impact of the 2014 drought include the reduction of flows in sources used by Guatemalan populations for consumption; increased energy consumption from having to extract water from greater depths and rationing in El Salvador; rationing and having to supply water via tanker trucks, thus increasing costs, in Honduras; and a reduction in the production capacity of water purification plants supplying urban aqueducts in Panama.

Press and summary of news items[5]

El Salvador

- Difficulties in supplying water for human, industrial and agricultural uses.

Honduras

- National emergency decreed due to drought.
- National Aqueducts Service (SANAA): it has become necessary to ration the water service, which has made it difficult to access water in low-income income neighbourhoods.
- 246 vulnerable micro-watersheds have been identified in 132 municipalities due to drought.
- Water rationing in at least 170 neighbourhoods in the capital city; water is supplied every three days; it has been reported that water sellers have increased the price for a barrel of water from 30 to 50 lempiras. Tanker truck owners pay SANAA 0.05 lempiras per gallon, and considering a barrel holds 55 gallons, they are paying a mere 2.75 lempiras per barrel.

Cost of the 2014 drought for the sector

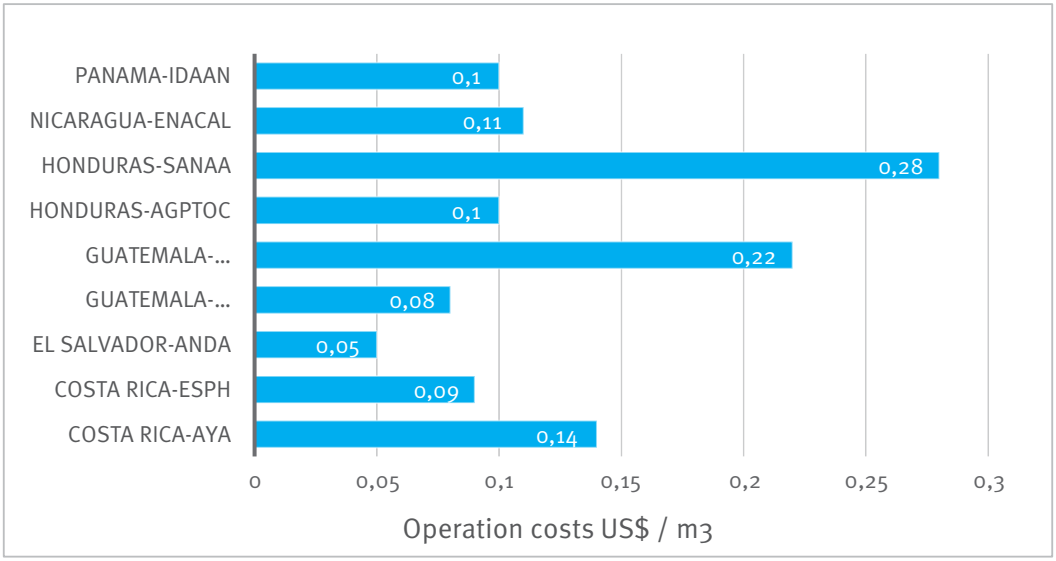
Estimating the financial cost of this type of event is not simple for many reasons. First, accounting and costing systems used by aqueduct managers in the region are not equipped to estimate the increase in costs that droughts represent. When drought causes an increase in pumping costs due to drops in groundwater levels, this increase is not entered as such in accounting systems. Furthermore, all countries in the region have multiple operators, including centralized institutions, municipalities and ministries, each with different systems. This makes it difficult to systematize this type of information; besides, each operator has different ways of addressing drought and most have hundreds of sources, which complicates things even more.

This is why this research uses a simple approach that allows making a generalization for the region using available data. One of the main financial implications of drought is the increase in the energy required for pumping water. Another is the drilling of new wells, to which a value is not assigned in this case. As ground water table levels drop, the effort required increases, and that increases operating costs. These costs vary across the region, as shown in Figure 13, ranging from US$ 0.05 to US$ 0.28 per cubic meter.

5 This is a summary of the news. See the Annex for more details, including date of publication.

FIGURE 13

Water companies in Central America, average cost of operation /m3



Source: Corton et al (2007)

A portion of total operating costs corresponds to the energy cost of pumping, which increases as rainfall decreases and ground water table levels fall. When studying the economic impact of the 2015 drought in California, Howit et al (2015) estimated that energy costs involved in water pumping increased by 31 per cent.

It is therefore possible to estimate the total amount of the energy cost increase to water provision using standard factors. Then, assuming a per capita water use of 250 litres per day and that drought affects water suppliers 90 days a year, the results shown in Table 10 are obtained. Since there is no precise information regarding how many connections or people were affected by the 2014 drought, results are provided as per 500,000 inhabitants "potentially affected". For instance, in the case of AyA in Costa Rica, for every 500,000 customers that were affected by the drought, the additional cost for power generation would be US$ 69,750, while for SANAA this amount would be US$ 104,625. It must be noted, moreover, that distribution networks in Central America have leaks which could account for up to 50 per cent of 'production', which would double those amounts

TABLE 11

Increase in energy costs from pumping for water companies in Central America, costs/m3

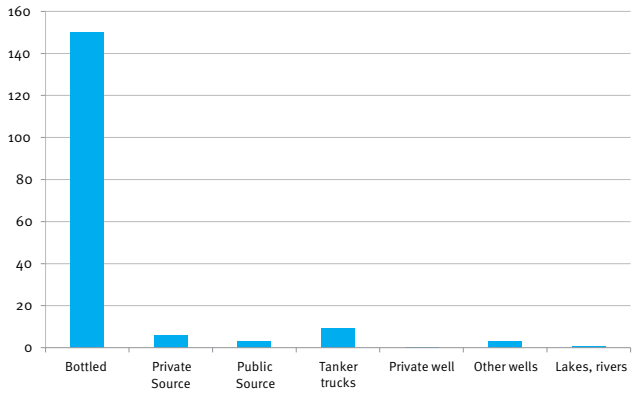
	Energy Costs US$/m3	Increase in energy costs (US$/m3)	US$/500,000 inhabitants affected
Panama-IDAAN	0,04	0,0124	139.500,00
Costa Rica-AYA	0,02	0,0062	69.750,00
El Salvador-ANDA	0,01	0,0031	34,875.00
Nicaragua-ENACAL	0,06	0,0186	209.250,00
Guatemala-EMPAGUA	0,12	0,0372	418.500,00
Honduras-SANAA	0,03	0,0093	104.625.00
Costa Rica-ESPH	0,02	0,0062	69.750,00
Honduras-AgPtoC	0,02	0,0062	69.750,00
Guatemala-EMAPET	0,06	0,0186	209.250,00

Source: Corton, María Luisa, et al (2007).

Since there are many different ways in which society defends against water shortages, the above results represent only a portion of the cost of drought. In some cases, it is not the operators who necessarily need to make the adjustments but rather the households, including bottled water, public and private sources (taps), wells, rivers and tanker trucks.

FIGURE 13

Average cost of alternative sources of water in US$/ m3 for cities in Central America.



Source: Stran 2004.

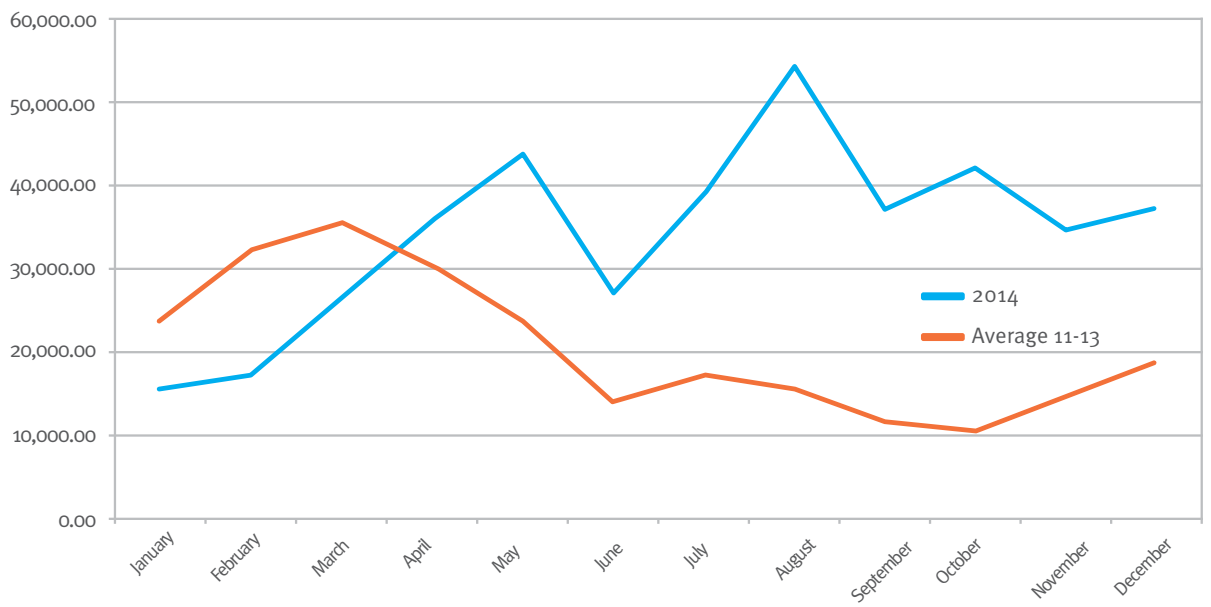
Note how families have different ways of securing water when service fails. As was to be expected, bottled water and tanker trunks are the most expensive, also needing to consider the amount of time families devote to this task. For example, while it is true that the value of water taken from rivers and lakes is zero, the cost in time for people to secure it is much higher. Stran (2004) estimated that in some cases the amount of time required is more than two hours per cubic meter, which entails significant social cost as this task is often carried out by women and children.

There are other costs involved in addition to those discussed so far (higher energy costs from pumping, higher water replacement costs and increased cost in terms of time invested by families). For instance, water that is not piped to homes is usually of lower quality and not pressurized, so it is harder to use for showers or clothes washing machines.

Despite the challenge of measuring the economic impact, provided below is an illustrative example for the case of Honduras. It is possible to analyse data of water sales made via tanker trucks in order to estimate the additional costs arising from such events. Figure 15 shows the marked increase in water sales via tanker trucks in Honduras between April and December 2015. The difference between average sales and sales made that year show some of the incremental costs required by operator companies to cope with drought. The total amounts to US$ 194,000 and represents the additional costs that the population had to provide to compensate for the lack of water in their homes.

FIGURE 14

Honduras: revenue from water sold via tanker trucks



Note: revenue corresponds to water sold via tanker trucks only. Data is provided by SANAA-Central Treasury Department. Source: “Billing Statistics Report”, which shows all SANAA Honduras revenues.

Alternatives/Recommendations

The following types of sector investments need to be supported to enable the region to better cope with future droughts.

Agriculture

While public and private initiatives exist to prevent impacts from water deficits, their scope between countries, regions and crop types are very diverse. These types of processes include technical assistance programmes, agricultural extension, and engineering measures such as laying pipelines and sprinkler systems for irrigation, and the construction of dams.

It is possible to use "climate-smart" agriculture that includes, among other things:

- Crop rotation to ensure resistance to drought and pests.
- Changing planting and harvesting periods.
- Improving the topography of the land to improve water availability and reduce wind erosion.
- Increase research around new drought-resistant crop varieties.
- Diversification is an option, for example, combining agriculture, forestry and animal husbandry.
- Introducing insurance may help people cope with crop failure.
- Dissemination of weather forecasts in advance.
- Promotion of water multi-use projects.
- Increasing irrigated areas in the region, especially in the Dry Corridor and Panama's *"Arco Seco"*.

Hydropower

As noted above, this sector is intrinsically resistant to climate change and drought because it operates based on infrastructures built precisely to regulate water flow. Thus, hydroelectric projects such as Arenal in Costa Rica and El Cajón in Honduras provide multi-year storage capacity to the region; i.e. they are built precisely to protect against climate variations.

Even so, some additional measures may be advisable:

- Increase in power use efficiency. A more efficient use of energy across the economy will save water in reservoirs for later use. In addition, it would reduce the impact of any rationing.
- Diversification of the energy matrix using renewable sources. The cost per kWh from these resources is decreasing every day. Emissions and generation costs will decrease in so far as power generation shortfalls are replaced by non-fossil fuels.
- Improve hydro-meteorological information. Information that is more accurate will enable integrated hydropower management because it will allow planning and taking measures that minimize the climate's impact on energy production, for example, reservoir management, the minimization of hydro-meteorological risks and other impacts.

WASH

The WASH sector can benefit from measures that reduce vulnerability to climate change in general and to drought events in particular. These can also have financial benefits. Measures may be aimed at different aspects of the hydrological cycle and also at the way in which water is used.

Recommended measures include:

- Protection of traditional water supply sources, including aquifer recharge areas, and river basins as a whole.
- Reducing physical loss of water during distribution to increase the available supply (or reduce the amount of water required to meet demand). In some countries these losses may be up to 50 per cent, as in Costa Rica for example (see National Water Resource Management Plan).
- Reduce commercial losses (unbilled water) to strengthen financial position of aqueduct operators.
- Include efficient water use systems in new urban developments, including, for example, rainwater harvesting.
- Increase water storage capacity at all levels, including households, in order to reduce their exposure to rationing and service interruptions.
- Improve water use efficiency among the population through socialization campaigns.
- Use progressive rates that punish high consumption.
- Promote reuse.

Conclusions

The 2014 drought caused considerable economic losses in Central America to the three sectors considered. This study has quantified some losses under conservative assumptions, so the values presented herein should be taken as a minimum.

"The cost associated with the 2014 drought is estimated at more than US$ 650 million in Central America, which is attributed to higher costs in electricity generation, the provision of water and the considerable losses to the agricultural sector."

In the case of hydroelectricity generation, the drought was addressed through increased fossil-fuel based thermal generation, which cost some US$ 190 million.

In the case of WASH sector, cost increases can be attributed to the use of tanker trucks and, in some cases, to increased energy use for pumping water, although these costs are much less than for hydroelectricity generation. It is estimated that total cost increases here may be a little more than US$ 1.5 million, mainly due to extra costs incurred for water pumping.

Finally, the case of agriculture is clearly the most severe, as corn and bean alone account for losses of around US$ 500 million. In addition to the losses suffered by producers, there are the effects through the economy in terms of jobs and price increases for all consumers. It should be noted that losses in hydroelectric and WASH sectors are socialized through the economy, while in agriculture, losses disproportionately affect those most vulnerable.

All these cost increases occur in contexts where the financial position of public or private companies that operate hydroelectric plants or aqueducts is weak. It is often impossible to adjust prices because sectors are regulated, and many of these companies, if not most, are not able to recover even normal operating costs. Like many others, AyA in Costa Rica would need to increase rates dramatically - which is not feasible politically - to pay for new infrastructure projects. This is a general problem across the region. The absence of adequate rates for water services, and the resulting impact on financial management and on the service delivery capacity of the relevant institutions, is a constant in the region.

This is noteworthy because the effect of the 2014 drought exacerbates this situation. Any additional costs faced by these companies only worsen their financial position, which means that existing gaps will only increase and that drought will cause delays in investment (which is insufficient as it is).

> *Based on this study, it is clear that that investing in reducing the vulnerability in agriculture may lead to great potential benefits.*

In addition to the above, there is the lack of policies at the national and regional level on the issue of drought. These phenomena are usually dealt with as they appear and the degree of preparedness is minimal (such as the establishment of compensation funds or even crop insurance). Regional organizations, including GWP, have committed to working on this issue, achieving progress in some cases.

The agricultural sector seems to be much more vulnerable to drought than the WASH and hydroelectric sectors. In the case of hydropower, reservoirs are precisely a climate change adaptation measure and protect against hydro-meteorological events such as drought. The sector is therefore inherently protected against climate change. Besides, electrical systems are interconnected, and many of the major hydroelectric projects in the region are located in the Atlantic, which allows reducing the risk.

Furthermore, some reservoirs in the region have a multi-year adjustment purpose.

Comparatively speaking it is clear that because of the economic vulnerability of the people involved, the agricultural sector is the most affected and the one that suffers the greatest impact. While electricity allows for replacement and water can be pumped from deeper sources, the economies of thousands of families are affected in a very negative way. As previously mentioned, drought can cause many farmers to lose their entire harvests, which also involves the families' loss of employment and self-sufficiency. The economic impact is huge.

In the case of water services, operators usually have various sources that allow them flexibility to handle the drought. Moreover, aquifers act as water storage capacity, providing additional security. It would be advisable to study the cumulative effect frequent drought may have on aquifers over time.

Economic evaluation is complicated due to the lack of information. Statistics and the way cost and revenue data are compiled are not designed to identify the economic impacts of hydro-meteorological events.

Based on this study, it is clear that conducting vulnerability reduction investments in agriculture may lead to great potential benefits. This includes promoting climate-smart agriculture that provides new ways of producing and using climate change-resistant varieties, and instruments such as parametric insurance that allow reducing the economic risk. It is necessary to remember that a significant percentage of the population lives from agriculture, and that it is precisely those with lower incomes.

This study clearly establishes that society must pay a high price for the lack of appropriate infrastructure works, and yet, the required investments are not made and investment portfolios are constantly delayed. This is linked to fees that for political reasons have remained historically unchanged and that have stood in the way of achieving total cost recovery or efficient water use. Proper rates will promote cost recovery, including the protection of watersheds and a more rational use of water resources.

It is necessary to have integrated policies at the national level that are able to address this issue through short, medium and long term measures, also considering institutional strengthening. These must comprise all three sectors under this study, but mainly agriculture, given its limited response capacity and the vulnerability of the people who depend on it.

> *“Overall, the region should prioritize the building of multi-purpose water storage infrastructure as one of its main climate change adaptation measures. This will have positive impacts in all three sectors discussed herein, and will bring the associated social and economic benefits.”*

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Annex 1

Electricity Rates

Quijivix (2013) conducted a study on the application of rate schedules and final charges in Central American countries. The information is as follows:

In the case of residential users:

- For the first category of consumption (0-100 kWh), rates are between 0.0703 and 0.1857 US$/kWh for Honduras and El Salvador respectively.
- For consumption above 100 KWh, rates are between 0.0955 and 0.3456 US$/kWh.
- In the case of Costa Rica, one same rate (0.1762 US$/kWh) is used in three consumption categories.
- Most countries' rates are approximately between 0.20 and 0.23 US$/kWh.

For commercial users:

- For consumption between 1000 - 5000 kWh, rates are between 0.1797 and 0.2983 US$/kWh for Honduras and Nicaragua respectively. Most countries' rates are 0.23 US$/kWh.
- For consumption above 5000 kWh, rates are between 0.1806 and 0.2805 US$/kWh; however, most the rates in most isthmus countries stand at 0.23 US$/kWh.

As for industrial users:

- Rates range between 0.1224 and 0.2368 US$/kWh.
- Costa Rica has one same rate for all consumption categories: 0.1813 US$/kWh

Summarizing the above, US$ 0.23 kWh can be considered the rate that reflects different users and consumption.

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Annex 2

List of 2014 drought-related news items

Month	Source	Costa Rica	Local currency	Cost in thousands of US$
July September November	Proyecto Mesoamérica La Nación La Prensa Nicaragua Siglo21	The most affected areas are the North Pacific, Central Pacific and South Pacific regions of Costa Rica, which produce the greatest amount of basic grains and livestock in the country. Losses are around US$ 13 million in the basic grain production sector and US$ 6.5 million in the livestock sector. Forage capacity is expected to decline by 75%, which would translate into the loss of 5.8 million litres of milk, 25 tonnes of meat and 2.4 tonnes of honey. Loss of other crops such as sugar cane, cantaloupes, rice, maize, bean, papaya, plantain, watermelon and passion fruit.	Loss to crops and livestock	13.000 6.500
July	La Nación	El Niño causes 10,500 million colones in losses in crops and livestock in Guanacaste. 7,000 million colones are losses to agriculture and 3,500 million colones to livestock production. MAG reported that 2,118 hectares of crops have been lost, and 11,718 others have been affected in varying degrees. 30,128 tonnes in agricultural products have been lost, in addition to 8,312 tonnes of milk, meat and honey. Drinking water shortages have also been reported. The most affected crop is maize, with 1,378 hectares lost, followed by 604 hectares of rice, 57 hectares of watermelon, 50 hectares of sugar cane and 29 hectares of bean. The drought has reduced meat production by 5,814 tonnes, meat by 2,496 tonnes and honey by 2.4 tonnes.	Loss due to drought	3.314
July	CR hoy	The Government announces a ¢ 27,000 million investment in Guanacaste to mitigate the drought's impact. Financing comes from two loans from the Central American Bank for Economic Integration (CABEI), US$ 6 million donation from China and 1,000 million colones from the Costa Rican Electricity Institute.	Transfer	9.292

Month	Source	El Salvador	Effect	Cost in thousands of US$
June	La Prensa Gráfica	The country will import 9,000 tonnes of duty-free red beans (approximately 200,000 *quintales*) from Mexico and Colombia to deal with the wave of "price speculation" that caused the price to rise from US$ 60 to US$ 100/*quintal*.	Variación precio	
July	La Prensa Gráfica	The quintal of the seda variety of red bean reached US$ 100 in San Salvador and US$ 105 in eastern regions due to shortages	Variación precio	
July August	Periódico El Salvador	The Government will allocate US$ 15 million toward the recovery of basic grain production in eastern areas, which consists of distributing 200,000 packs of bean seed and 15,000 packs of maize and sorghum seed.	Transferencia	15.000

Month	Source	El Salvador	Effect	Cost in thousands of US$
August	La Prensa Gráfica	Loss of 3.4 million *quintales* of maize and 2,700 manzanas of bean. US$ 500.000 for a contingency plan for the livestock sector. MAG invested US$ 20,224,000 in maize seed and fertilizer.	Transfer	500 20.224
August September	La Prensa Gráfica SICA	Crop damage from drought amounts to US$ 85 million. 8 million *quintales* of basic grains were lost from an area of 165,000 *manzanas*. The Central American Federation of Chambers of Agriculture and Agroindustry (FECAGRO) estimated that 30 per cent of the territory suffered damages due to the lack of rain. In the case of El Salvador, 45,000 *quintales* of beans were lost out of a total of 4 million *quintales* of grains lost.	Agriculture loss	85.000
August	Diario Colatino	MAG approved the import of 470 tonnes of bean, approximately 20,141 *quintales*. The price for beans of the seda variety reached US$ 115/*quintal* and US$ 106/*quintal* for the tinto variety.	Price variation	
September	SICA	The Agriculture and Livestock Development Bank (BFA) reported US$ 8.2 million in losses due to the drought. The Agriculture and Livestock Development Bank (BFA) reported US$ 8.2 million in losses due to the drought. That US$ 8.2 million are being condoned as part of the Agricultural Guarantee Programme (PROGARA) that operates with funding from the Development Bank of El Salvador (BANDESAL). BFA granted 21,394 loans to plant 77,000 *manzanas* of beans, maize, rice and sorghum. Of these, 8,501 were affected by the meteorological event. The land affected amounts to 18,361 *manzanas* (23.7 per cent).	Loss to financial sector	8.200
September	SICA	Black bean sales quadruple. GUMARSAL sold 1,700 *quintales* in August and 1,300 more *quintales* in July (2014); however, red bean prices have reached between US$ 1.15 and US$ 1.50 per pound, while the pound of black bean sold for US$ 0.75. El Salvador has suffered a drought that has led to the loss of more than 9 million *quintales* of grain. GUMARSAL said that the price per pound of red bean would stall below the US$ 1 mark thanks to 100 containers of grain being imported from Ethiopia.	Price variation	
September-October	SICA La Prensa Gráfica	The drought in July caused US$ 70 million in losses; by August this figure is expected to reach US$ 82,252,500. More than 9 million *quintales* have been lost. 250,000 direct and indirect jobs have been lost. 3.7 million *quintales* of white maize and 55,000 *quintales* of bean were never planted, affecting 102,000 households that depended on agriculture.	Loss	70.000 82.252
October	La Prensa Gráfica	The price of the seda variety of red bean had not been regulated and prices remained above US$ 1/pound, and quintal was being sold for US$ 125. The price of beans in the San Salvador Metropolitan Area continues to rise, although prices vary between departments. In Gerardo Barrios Street, the seda variety of red bean sells for US$ 1.50/pound, which in the markets of Santa Tecla and San Marcos sells for between US$ 1.40 and US$ 1.50. In San Salvador the price per quintal ranges between US$ 122-130.	Price variation	

Month	Source	Guatemala	Effect	Cost in millions of US$
August September	Siglo21 SICA	People affected by drought will receive maize, beans and flour for 6 months. 45.2 kg of maize, 13.5 kg of beans and 7.9 kg of fortified atol were distributed across 7 locations.	Transfer	10.835,5
August	Siglo21	US$ 900,000 will be donated to families affected by drought.	Transfer	900
August	Prensa libre	The Government announced it needs 500 million quetzales to respond to 236,000 families.	Transfer	65.274
September October	SICA Siglo21 Reliefweb. Proyecto Mesoamérica Bonilla, 2015	Drought affects 1.2 million people from 3,571 communities in 210 municipalities. 266,000 families affected. Loss of between 5 and 6 per cent of crops. 80 per cent of maize crops and 63 per cent of bean crops have been lost. Loss of 1.89 million *quintales* of maize, which accounts for 4.7 per cent. 661,000 *quintales* of bean lost, which accounts for 26 per cent of domestic production.	Loss from maize and beans	57.000

Month	Source	Honduras	Effect	Cost in millions of $US
January	Proyecto Mesoamérica	The drought has severely hit 10 departments and 64 municipalities in southern areas of the country. 76,712 small producer families affected: 37,131 maize producers, 14,075 bean producers and 25,506 sorghum producers. Bean price increases of up to 132 per cent. 4,221,301 *quintales* of maize and 229,346 *quintales* of bean have been lost. 10 departments and 64 municipalities in the Dry Corridor. 76,712 small producer families affected: 37,131 maize producers, 14,075 bean producers and 25,506 sorghum producers.	Price variation	
August	Estrategia y Negocios	The Government will open a US$ 71-million trust in view of the losses caused by the drought. 76,000 families affected by drought have been served.	Trust	71.000
August	El Heraldo	The Government aims to assist 76,000 families affected by the drought's severity. The Government is conducting financing efforts to secure US$ 150 million from abroad aimed at driving irrigation programmes. It will promote the irrigation of some 50,000 hectares, at a rate of 6,500 hectares per year. Of 400,000 hectares in production, 150,000 hectares are operating under irrigation systems.	Transfer	150.000
August September	El Heraldo SICA	Trust to reactivate Honduran agriculture is ready. The Trust for reactivating the agricultural sector is providing L1,500 million in resources. Interest rates between 7.25 and 8%, 15-year term and three-year grace period. According to reports, rain shortages have devastated 70 per cent of maize crops and 45 per cent of bean crops.	Loan	66,37

Month	Source	Honduras	Effect	Cost in millions of $US
September	SICA	The Government is seeking international cooperation to cope with the drought. Under the right to humanitarian assistance, it has requested between US$ 27-30 million to continue to respond to the more than 112 municipalities, plus 55 others that have requested support.	Transfer	8.000
September	El Heraldo	The U.S. Government will allocate US$ 3.9 million to support food security in Honduras, especially programmes targeted at people affected by drought and coffee rust. In addition, the United States allocated US$ 190,000 to support some of the communities most affected by drought in the departments of Lempira, Intibucá and La Paz. Within the framework of the Dry Corridor Alliance, the U.S. Government contributed US$35 million to lift 50,000 families out of poverty.	Transfer	3.900 190
September	El Heraldo	The Government allocates 210 million lempiras to the Dry Corridor to prevent drought.	Transfer	9.292
October	El Heraldo	The Government of Taiwan donated 3.1 million lempiras to the Honduran Government to implement the Food Security Plan of Action for Drought. This will help improve and ensure food and nutritional security for dozens of families in the interior of the country. Some 76,000 families living in the Dry Corridor were affected by drought.	Transfer	137

Month	Source	Nicaragua	Effect	Cost in thousands of US$
November	Proyecto Mesoamérica	Greater impact to the Dry Corridor, comprising 68 municipalities, the most affected. Loss to maize and bean production. In 32 municipalities, of a 60,600-*manzana* area dedicated to maize cultivation, 41,000 *manzana*s were lost. As for bean, of a 37,574-*manzana* area, 26,073 *manzanas* have been lost, affecting 40,000 families. At the national level, 57,000 of 275,000 *manzanas* of maize have been lost. In the case of beans, 31,000 of the 100,000 *manzanas* planted have been lost completely. Maize production for the 2013-2014 cycle is estimated at 8.3 million *quintales*, 11.7 per cent less than the previous cycle. 2,500 head of cattle have died from lack of water. Currently, 600,000 head of cattle are facing grass or forage shortages.	Losses to agriculture sector	9.292
July	La Prensa	One pound of beans is selling for C$ 33 in Estelí. Some consumers have no problem switching from red to black beans when the first becomes scarce or increases in price (to between C$ 31 and C$ 33 per pound), although clearly there are families whose incomes do not allow them to buy red beans at that price. The price difference between black and red beans can be up to C$ 18 or C$ 20.	Price variation	

Month	Source	Nicaragua	Effect	Cost in thousands of US$
August	El Nuevo Diario	The price being paid to small and medium-sized producers by dairy product processors fell by 4 or 5 córdobas, from 38 córdobas per gallon. Milk producers not affiliated to cooperatives are being paid between 28 and 32 córdobas per gallon. Variations in fat percentages when buying the milk is also affecting the price per gallon. These are the consequences of unwatered pastures.	Price variation	
August	La Prensa	According to the Nicaraguan Federation of Livestock Associations (FAGANIC), there are one million malnourished cattle in the country's dry zone. This has two types of repercussions: on livestock reproduction and on employment generation. The Government's proposed solutions: facilitating transport of food by-products and a US$ 300,000 fund.	Transfer	300
Agosto	El Nuevo Diario	Food shortages and rising red bean prices worried coffee growers. The pound of red beans at the time sold for C$ 30 and black beans sold for C$ 15. The daily ration of beans and maize per person is half a pound and one pound respectively. It is estimated that in Jinotega 2,700 *quintales* of beans, 5,500 *quintales* of maize and 700 *quintales* of rice per day are required to supply 55,000 coffee pickers.	Price variation	

Month	Source	Panama	Effect
Julio	Panamérica	Rice cultivation and harvest are down this year. Production has been reduced by 50 per cent, while at the same time experiencing a reduction in producers as well. In 2013-2014, the cost of planting one hectare of rice in Chiriquí was US$ 2,160, which rose to US$ 2,200.	Increase of price/hectare

Water Resources

Country	Source	News
El Salvador	Bonilla(2015) La Prensa Gráfica	Difficulties in supplying water for human, industrial and agricultural uses. Bonilla (2015). Hydroelectric production: a 2 per cent shortfall is expected, as well as a 15 per cent drop in the volume stored in the main reservoirs (Cerrón Grande and Guajoyo). According to data from the State's National Energy Council (CNE), to 27 July 2014 electricity generated from water (hydroelectric) has gone down in relation to the previous year's patterns. One of the main hydroelectric power generators in the country, the 15 de Septiembre plant, has reduced power generation by more than 51 per cent. In July 2013, this plant generated an average of 2,119.7 megawatts (MW/h) per day; however, by July of this year generation has been almost halved, producing an average of 1,034.4 MW/h per day. The Cerrón Grande plant is experiencing another factor besides a reduction in power generation, and that is that reservoir levels have dropped. In this case, energy production decreased by 15.1 per cent.
Honduras	La Prensa	National emergency decreed due to drought. Food security plan for drought, 10 municipalities for the construction of water harvesting works, participatory early warning system, climate change strategy for the agricultural sector. National Aqueducts Service (SANAA): it has become necessary to ration the drinking water service, which has made it difficult to access water in low-income income neighbourhoods. 246 vulnerable micro-watersheds have been identified in 132 municipalities due to drought. In view of the decline in energy production from water sources, there must be more thermal generation and import. Chamber of Commerce in Tocoa, Colón: no electricity for eight hours a day. The losses caused by these energy issues are unquantifiable.
Costa Rica	Siglo 21 La Nación	The drought suffered by Costa Rica triggered alerts regarding the use of hydroelectric dams. Water reserves are being used moderately, said the Costa Rican Electricity Institute (ICE). The lack of rainfall in the country affects watershed areas where hydroelectric plants are located. Using the Arenal reservoir (in northeaster Costa Rica) as a reserve has been fundamental to solving situations such as these. In view of the intense drought, measures include well drilling and improvements to water catchment systems, recovery of the Arenal Lake reservoir and other actions The generation of electricity at CoopeGuanacaste is down 10 per cent.

Annex 3

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Mific: llegará primer embarque de frijol rojo (3 julio, 2014) (http://www.laprensa.com.ni/2014/07/03/nacionales/201555-mific-llegara-primer-embarque-de-frijol-rojo)

Resumen: el gobierno autorizó la importación de 200 mil quintales de frijoles de Etiopía, con lo que se espera presionar a que el frijol rojo baje de precio.

PMA ayudará a mitigar efectos de sequía (8 junio, 2014) (http://www.laprensa.com.ni/2014/07/08/politica/202334-pma-ayudara-a-mitigar-efectos-de-sequia)

Ganaderos piden fondo de emergencia (9 de julio, 2014) (http://www.laprensa.com.ni/2014/07/09/economia/202397-ganaderos-piden-fondo-de-emergencia)

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Agricultores temen que sequía genere hambruna (14 julio, 2014) (http://www.elnuevodiario.com.ni/economia/324710-agricultores-temen-que-sequia-genere-hambruna/)

Prácticas para enfrentar el clima (14 julio, 2014) (http://www.laprensa.com.ni/2014/07/14/economia/203118-practicas-para-enfrentar-el-clima)

Esperan que con la cosecha de agosto baje el precio (15 julio, 2014) (http://www.laprensagrafica.com/2014/07/15/esperan-que-con-la-cosecha-de-agosto-baje-el-precio)

Frijol etíope será almacenado (18 julio, 2014) (http://www.laprensa.com.ni/2014/07/18/economia/203712-frijol-etiope-sera-almacenado-2)

Resumen: los 110 mil quintales comprados por el gobierno a Etiopía no saldrán al mercado local. Los nicaragüenses no se deberían preocupar, ya que los 440 mil quintales de frijol y los 605 mil quintales de maíz estarán seguros en las bodegas del Ministerio de Fomento, Industria y Comercio, y saldrán a disposición del público cuando consideren necesario debido al acaparamiento y a la especulación que se ha dado alrededor del grano.

Costa Rica declara alerta por fenómeno de El Niño (22 julio, 2014) (http://www.laprensa.com.ni/2014/07/22/internacionales/204351-costa-rica-declara-alerta-por-fenomeno-de-el-nino)

Ahora falta semilla de frijol rojo (23 julio, 2014) (http://www.laprensa.com.ni/2014/07/23/nacionales/204441-ahora-falta-semilla-de-frijol-rojo)

Libra de frijol a C$33 en Estelí (24 julio, 2014) (http://www.laprensa.com.ni/2014/07/24/departamentales/204587-libra-de-frijol-a-c33-en-esteli)

Quieren mejorar la genética (25 julio, 2014) (http://www.laprensa.com.ni/2014/07/25/economia/204696-quieren-mejorar-genetica)

Ganaderos piden que se declare emergencia (28 julio, 2014) (http://www.laprensagrafica.com/2014/07/28/ganaderos-piden-que-se-declare-emergencia)

Sequía no da tregua (30 julio, 2014) (http://www.laprensa.com.ni/2014/07/30/nacionales/205444-sequia-no-da-tregua)

Baja producción persiste desde hace dos décadas (7 agosto, 2014) (http://www.elHeraldo.hn/economia/736268-216/baja-producci%C3%B3n-persiste-desde-hace-dos-d%C3%A9cadas)

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Prometen asistencia inmediata a familias (12 agosto, 2015) (http://www.elHeraldo.hn/pais/737400-331/prometen-asistencia-inmediata-a-familias)

Cosecha de postrera todavía no baja el precio de frijol rojo en Honduras (14 agosto, 2014) (http://www.elHeraldo.hn/pais/738685-364/cosecha-de-postrera-todav%C3%ADa-no-baja-el-precio-de-frijol-rojo-en)

Sequía en Honduras pone en riesgo un millón de quintales de café (17 agosto, 2014) (http://www.elHeraldo.hn/pais/739016-435/sequ%C3%ADa-en-honduras-pone-en-riesgo-un-mill%C3%B3n-de-quintales-de-caf%C3%A9)

Imparable fuga de frijoles hacia El Salvador (18 agosto, 2014) (http://www.elHeraldo.hn/economia/739388-216/imparable-fuga-de-frijoles-hacia-el-salvador)

Listo fideicomiso que reactiva agro hondureño (19 agosto, 2014) (http://www.elHeraldo.hn/minisitios/hondurenosenelmundo/migrantes/739722-364/listo-fideicomiso-que-reactiva-agro-hondure%C3%B10)

Comprarán 200 mil quintales con L. 20 millones (30 agosto, 2014) (http://www.latribuna.hn/2014/08/30/compraran-200-mil-quintales-con-l-20-millones/)

Damnificados por sequía recibirán maíz, frijol y harina por 6 meses (11 agosto, 2014) (http://www.s21.com.gt/nacionales/2014/08/11/damnificados-sequia-recibiran-maiz-frijol-harina-6-meses)

Pérdida agrícola es de Q26 millones (13 agosto, 2014) (http://www.prensalibre.com/huehuetenango/Huehuetenango-municipios-sequia-perdida-cultivos-agricultores-lluvia_0_1192080988.html)

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Gobierno pedirá ayuda internacional por sequía en el país (23 agosto, 2014) (http://www.prensalibre.com/huehuetenango/huehuetenango-sequia-Guatemala-Gobeirno_0_1198680275.html)

Daños por sequía prolongada costarían Q500 millones (25 agosto, 2014) (http://reliefweb.int/report/guatemala/da-os-por-sequ-prolongada-costar-q500-millones)

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Reduce al 65% probabilidad de desarrollo de fenómeno El Niño (8 agosto, 2014) (http://www.laprensagrafica.com/2014/08/08/reduce-al-65-probabilidad-de-desarrollo-de-fenomeno-el-nio)

Agricultores solo cosecharon deudas (9 agosto, 2014) (http://www.elsalvador.com/articulo/nacional/agricultores-solo-cosecharon-deudas-57915)

Falta de lluvias aumentó los daños en agricultura y MAG minimiza impacto (9 agosto, 2014) (http://www.elsalvador.com/articulo/nacional/falta-lluvias-aumento-los-danos-agricultura-mag-minimiza-impacto-55373)

Afectados por sequía en oriente recibirán paquetes de semilla (8 agosto, 2014) (http://www.laprensagrafica.com/2014/08/08/afectados-por-sequia-en-oriente-recibiran-paquetes-de-semillas)

Gobierno prepara ayuda para productores afectados por sequía (12 agosto, 2014) (http://www.laprensagrafica.com/2014/08/12/gobierno-prepara-ayuda-para-productores-afectados-por-sequia)

Lluvias de julio las más bajas en 44 años (13 agosto, 2014) (http://www.laprensagrafica.com/2014/08/13/lluvias-de-julio-las-mas-bajas-en-44-aos)

180.000 qq de maíz perdidos por la sequía (13 agosto, 2014) (http://www.laprensagrafica.com/2014/08/13/180000-qq-de-maiz-perdidos-por-la-sequia)

$85 millones en pérdidas de granos por la sequía (14 agosto, 2014) (http://www.laprensagrafica.com/2014/08/14/85-millones-en-perdidas-de-granos-por-la-sequia)

Altos precios en granos básicos es por sequía que azota la región, según FECAGRO (19 agosto, 2014) (http://www.elsalvador.com/articulo/negocios/altos-precios-granos-basicos-por-sequia-que-azota-region-segun-fecagro-60384)

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Centroamérica pidió asistencia a México para enfrentar sequía (28 agosto, 2014) (http://www.laprensagrafica.com/2014/08/28/centroamerica-pidio-asistencia-a-mexico-para-enfrentar-sequia)

Arroceros en busca de apoyo debido a sequía (29 agosto, 2014) (http://www.elsalvador.com/articulo/negocios/arroceros-busca-apoyo-debido-sequia-56551)

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Producción de caña disminuirá 5% (10 setiembre, 2014) (http://www.sica.int/busqueda/Noticias.aspx?IDItem=91100&IDCat=2&IdEnt=916)

Gobierno y productores afinan plan para ciclo de postrera (6 setiembre, 2014) (http://www.sica.int/busqueda/Noticias.aspx?IDItem=91074&IDCat=2&IdEnt=916)

Más de 180.000 familias afectadas por la sequía (16 setiembre, 2014) (http://www.sica.int/busqueda/Noticias.aspx?IDItem=91176&IDCat=2&IdEnt=916)

Estados Unidos asignará USD 3.9 millones en apoyo a Honduras (25 setiembre, 2014) (http://www.elHeraldo.hn/inicio/751446-331/estados-unidos-asignar%C3%A1-usd-39-millones-en-apoyo-a-honduras)

Gobierno destina 210 millones de Lempiras a Corredor Seco para prevenir sequía (26 setiembre, 2014) (http://www.elHeraldo.hn/pais/751915-214/gobierno-destina-210-millones-a-corredor-seco-para-prevenir-sequ%C3%ADa)

BFA condona $8,2 millones en créditos tras la sequía (2 setiembre, 2014) (http://www.sica.int/busqueda/Noticias.aspx?IDItem=90920&IDCat=2&IdEnt=916)

Aumenta venta de frijol negro en los mercados (3 setiembre, 2014) (http://www.sica.int/busqueda/Noticias.aspx?IDItem=90923&IDCat=2&IdEnt=916)

C.A. requerirá más de $2.000 millones tras sequía (10 setiembre, 2014) (http://www.sica.int/busqueda/Noticias.aspx?IDItem=91071&IDCat=2&IdEnt=916)

Sequía provoca pérdidas de $70 millones, según el MAG (11 setiembre, 2014) (http://www.sica.int/busqueda/Noticias.aspx?IDItem=91156&IDCat=2&IdEnt=916)

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Sequía cambia actividades productivas en el Arco Seco (2 setiembre, 2014) (http://www.sica.int/busqueda/Noticias.aspx?IDItem=90956&IDCat=2&IdEnt=916)

Agobiados por la sequía (6 setiembre, 2014) (http://www.sica.int/busqueda/Noticias.aspx?IDItem=91104&IDCat=2&IdEnt=916)

Programa Mundial de Alimentos ONU pide ayuda ante sequía en Centroamérica (11 setiembre, 2014) (http://www.sica.int/busqueda/Noticias.aspx?IDItem=91189&IDCat=2&IdEnt=916)

Costa Rica declara emergencia por sequía en litoral Pacífico (30 setiembre, 2014) (http://www.s21.com.gt/internacionales/2014/09/30/costa-rica-declara-emergencia-sequia-litoral-pacifico)

Entrega de alimentos en Corredor Seco durará seis meses (1 setiembre, 2014) (http://www.sica.int/busqueda/Noticias.aspx?IDItem=90873&IDCat=2&IdEnt=916)

Se inicia entrega de alimentos a los afectados por sequía (1 setiembre, 2014) (http://www.sica.int/busqueda/Noticias.aspx?IDItem=90867&IDCat=2&IdEnt=916)

Arranca el plan oficial para atender la sequía (2 setiembre, 2014) (http://www.sica.int/busqueda/Noticias.aspx?IDItem=90969&IDCat=2&IdEnt=916)

Entrega de alimentos para afectados por sequía iniciará en octubre (9 setiembre, 2014) (http://www.sica.int/busqueda/Noticias.aspx?IDItem=91042&IDCat=2&IdEnt=916)

Maíz y frijol generan aumento en índice inflacionario de agosto (9 setiembre, 2014) (http://www.sica.int/busqueda/Noticias.aspx?IDItem=91040&IDCat=2&IdEnt=916)

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