

PROCEEDINGS  
**CENTRAL AMERICAN  
AND DOMINICAN  
REPUBLIC FORUM ON  
WATER AND FOOD  
SECURITY:  
THE WATER - FOOD  
PRODUCTION  
NEXUS**

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# > Table of Contents

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- 4 Message from the GWP Chair of the Technical Committee
- 5 Presentation
- 6 Introduction
- 7 Brief Conceptual Framework
- 8 Forum Objectives
- 9 Overview of Presentations
- 10 Pillars of Costa Rica's Agri-food Policy: The Importance of Sustainable Water Management. [Gloria Abraham Peralta, Costa Rica Minister of Agriculture and Livestock \(MAG\)](#)
- 12 [Keynote presentation](#)  
Water Security: Essential for Meeting the Challenge of Feeding 9 Billion People. [Mohamed Ait-Kadi, Chair of the Global Water Partnership \(GWP\) Technical Committee](#)
- 16 Food and Nutrition Security in Central America and the Dominican Republic: Trends and Challenges. [Jose Emilio Saudi H., Representative of the United Nations Food and Agriculture Organization \(FAO\) in Costa Rica.](#)
- 20 Cooperation Programme on Agriculture and Irrigation for Mexico, Central America and Dominican Republic. [Diego Montenegro, Coordinator for Central America and representative of the Inter-American Institute for Cooperation on Agriculture \(IICA\) in Costa Rica](#)
- 22 Food Security Policies at the Regional Level and their Relationship to Water Management. [Manuel Jimenez, specialist from the Central American Agricultural Council \(CAC\)](#)
- 25 Climate Predictions and Food and Nutrition Security. [Patricia Ramirez, Executive Secretary of the Regional Committee on Water Resources \(CRRH-SICA\)](#)
- 27 Actions for Food and Water Security in Central America: Progress and Challenges Bernal Soto. [Executive Director for the National Irrigation and Drainage Service \(SENARA\), Costa Rica](#)
- 30 Aquaculture Industries in the Arenal-Tempisque Irrigation District (DRAT). [Walter Cruz, Administrative Manager, Tilapias del Sol](#)
- 31 Governance and Integrated Management of Water Resources in Central America. [Maureen Ballestero, Chair of GWP Costa Rica](#)
- 32 Conclusions
- 34 Annexes

## > Message from the Chair of the GWP Technical Committee

The GWP Technical Committee (TEC) is a group of professionals and scientists who are recognized internationally for their intellectual input on the different aspects of water management.



The Chair of the GWP Technical Committee, Dr. Mohamed Ait-Kadi, was the keynote speaker at the forum.

One of the issues that TEC is addressing is the global challenges involved in achieving water security, including the link between climate change and food security. Food security is also linked to energy security, urban population growth, and environmental protection, among others, and these also need to be addressed in an integrated manner. To do this, we need to improve understanding of these issues at the regional level and develop more complex and coordinated responses.

The Technical Committee is committed to supporting actions that seek to promote coordination between the agriculture and water resources sectors. In this way they can jointly

identify the challenges facing food and water security, share the progress being made, and seek solutions at regional and national levels. These actions are an integral part of the "knowledge chain" concept that GWP promotes.

The "Central American and Dominican Republic Forum on Water and Food Security: The Water and Food Production Nexus", was held in San Jose, Costa Rica on August 9, 2012. It was an excellent opportunity to better understand the reality of food and water security in the region and to observe the commitment that exists at the Central American Integration System (SICA) and other governmental and non-governmental organizations to pursue and implement integrated solutions essential for socio-economic development in Central America.

The GWP Technical Committee is honoured to have been part of this effort and has therefore supported the publication of this report.

A handwritten signature in black ink, which appears to read "Mohamed Ait-Kadi".

Mohamed Ait-Kadi  
Presidente del Comité Técnico  
Global Water Partnership

## > Presentation

There are a number of global challenges that need to be addressed to promote sustainable growth, while considering financial, social, and environmental factors. One of these challenges that cause great concern is the need to feed a growing population.

There are a number of global challenges that need to be addressed to promote sustainable growth, while considering financial, social, and environmental factors. One of these challenges that cause great concern is the need to feed a growing population.

In only 13 years the global population has increased by one billion, and projections indicate that by 2050 the world will have 9 billion people, which will require a 70% increase in global food production. This challenge puts pressure on all natural resources, but especially on water. Agriculture is the largest consumer of water worldwide, accounting for nearly 70% of freshwater withdrawn from lakes, rivers, and aquifers, which demonstrates the direct relationship between water and agriculture for food production.

In order to assess this issue among the different sectors involved, a regional forum on the water and food production nexus was organized. The *“Central American and Dominican Republic Forum on Water and Food Security: The Water and Food Production Nexus”* took place on August 9, 2012 in San José, Costa Rica.

The forum was organized by GWP Central America in coordination with the Central American Agricultural Council (CAC), the National Irrigation and Drainage Service of Costa Rica (SENARA), and the Ministry of Agriculture and Livestock of Costa Rica (MAG). More than 150 representatives of government and civil society, from the agriculture and water sectors, from the countries of Belize, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama and Dominican Republic, participated in the event.



The Chair of GWP Central America, Mr. Victor Campos and the Executive Secretary of CAC, Mr. Julio Calderon.

The event was inaugurated by Mr. Victor Campos, the pro tempore regional Chair of GWP Central America. International and regional experts participated, including Ms. Gloria Abraham Peralta, Minister of Agriculture and Livestock of Costa Rica (MAG) and vice president pro tempore of the CAC, Mr. Julio Calderon, Executive Secretary of CAC, and Dr. Mohamed Ait-Kadi, Chair of the GWP Technical Committee.

As part of the outcome of this event, a Memorandum of Agreement was signed by GWP and CAC, to strengthen the coordination of actions to achieve food and water security in the region.

This publication documents the presentations of the experts who participated in the forum in order to encourage regional dialogue. The proceedings include the objectives of the event, the content of the presentations, and the event agenda.



The Minister of MAG Costa Rica, Gloria Abraham, was a speaker at the inauguration of the forum. Also present: Maureen Ballestero of GWP Costa Rica, Jose Emilio Suadi of FAO Costa Rica, Victor Campos Chair of GWP Central America, Mohamed Ait-Kadi Chair of GWP TEC, and Julio Calderon of CAC.

## > Introduction

Currently, Food and Nutrition Security (FNS) is considered one of the greatest challenges facing humanity and is closely related to challenges clearly defined in the Millennium Development Goals (MDG), such as the reduction of hunger and extreme poverty.

Currently, Food and Nutrition Security (FNS) is considered one of the greatest challenges facing humanity and is closely related to challenges clearly defined in the Millennium Development Goals (MDG), such as the reduction of hunger and extreme poverty.

Reducing food and nutrition insecurity is not an easy task, since it must be achieved in the context of climate change and its implications for human welfare, such as water resources, health, energy, and biodiversity.

Today, climate change is altering the capacity and form of agricultural production, especially as available water is diminishing in quantity and quality.

Clearly, this adverse effect of climate change makes it harder to gain access to food, it increases price volatility and it produces extreme hydro-meteorological events that impact on livelihoods and biodiversity.

The world's growing population requires an increasingly greater amount of food. As a result, it exerts strong pressures on food production and on natural resources, especially water, which is scarce in some regions, for example, in the dry corridor of the Central American isthmus.

Despite this situation, Central America and the Dominican Republic in general have sufficient water resources in terms of quantity. However, the availability of water resources for agriculture is affected by irregular spatial and temporal distribution of rainfall, insufficient regulation works, and the degradation of watersheds and water quality, which negatively affects food production capacity.

The adverse effects of climate variability and change on food production have a great impact on the Central American region, since between 80 and 98 per cent of agricultural areas there depend on precipitation.

Within this context, it is necessary to establish a dialogue between experts in both the agricultural and water sectors in order to achieve better coordination between them and the identification of actions that promote food, nutrition, and water security for populations in Central America and the Dominican Republic. It is also necessary to train and raise awareness among these specialists with regard to the intrinsic connection between water and food and nutrition security.

For this reason, the GWP Central America, the Central American Agricultural Council (CAC), the Costa Rica National Irrigation and Drainage Service (SENARA), and the Costa Rica Ministry of Agriculture and Livestock (MAG) organized the *"Central American and Dominican Republic Forum on Water and Food Security: The Water and Food Production Nexus"*.



## > Brief Conceptual Framework

According to the United Nations Food and Agriculture Organization (FAO), food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

To achieve Food and Nutrition Security (FNS), it is necessary to consider three fundamental pillars: the availability of sufficient quantities of food for all people, access to the resources necessary to obtain their food, and the use of those resources for good nutrition.

Food security is a multidimensional concept comprising availability, access, use (consumption and biological utilization) and stability. The

effects of climate change can be perceived in each of these dimensions, some of which relate to food production. For example, availability is affected by factors such as reduced productivity, geographic redistribution of food production, and by expected increases in international trade prices, which not only reflect a change in the price of products, but also the effect that international transport has on the energy matrix.

Among other things, access is affected by increased difficulties in generating production for own consumption because of upward trends in and volatility of prices and deteriorating livelihoods.

Consumption and biological utilization is negatively affected by biodiversity loss, its repercussion on the amount and variety of food, and by the effects of climate variation on health. Furthermore, stability – both in terms of supply and access – is affected by such aspects as increasing climate variability, which affects the availability of water resources for agriculture. The market crisis is in some cases caused by climate disturbances, especially those related to hydro-meteorological events.

Water security is defined as the availability of an acceptable quantity and quality of water for health, the production of goods, services, and

livelihoods, coupled with an acceptable level of water-related risks (Grey and Sadoff, 2007).

To achieve water security, it is necessary to invest in more accessible and appropriate information, in stronger and more flexible institutions, and in natural and artificial infrastructure for water storage, transportation and treatment. It will be necessary then, to have a combination of "hard" measures (infrastructure) and "soft" measures (institutional) to achieve lasting results in different areas, whether at the local, national, regional or watershed level.

Integrated Water Resources Management (IWRM) offers an approach to address these elements, since it recognizes the holistic nature of the water cycle, the relationship that exists between different water uses, and the importance of effective institutions and user participation at all levels.

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## > Forum Objectives

### General Objective

~ To contribute to an efficient, competitive, environmentally sustainable, safe and inclusive food production, that is based on efficient water use, in order to advance towards food, nutrition, and water security in the member countries of the Central American Integration System (SICA).

water management in agricultural sector policies, strategies, plans, programmes, and projects at the national and regional levels.

~ To identify challenges and opportunities for efficient and sustainable water use in food production that could contribute to decision-making regarding adaptation to climate change.

### Specific Objectives

~ To raise awareness about the link between water and food security, as well as to promote coordination between experts in the agriculture and water sectors.

~ To promote the inclusion of sustainable

The proceedings of the *“Central American and Dominican Republic Forum on Water and Food Security: The Water and Food Production Nexus”* include the key information shared by speakers at this event, which was held on August 9, 2012, in San José, Costa Rica.



## > Overview of Presentations





Cachi dam in Costa Rica. Photo: CC by mdverde on Flickr.

## Pillars of Costa Rica's Agri-food Policy: The Importance of Sustainable Water Management

Gloria Abraham Peralta, Costa Rica Minister of Agriculture and Livestock (MAG)

The speaker started her presentation explaining the current status of natural resources. She stressed that water resources are increasingly scarce and as an example mentioned the 95% reduction in flow that certain rivers experience, some of them failing to reach the sea year-round.

She also mentioned that large lakes and inland seas have shrunk and half the wetlands of Europe and North America no longer exist, due to climate change which has triggered changing temperatures and intensification in the magnitude of climate disasters.

In terms of natural resources in general, Abraham pointed out that there has been a reduction in the quality and quantity of natural resources for production and life, which has increased competition for their use.

Soils, for example, have suffered a 46.6% decrease in productivity, while 85% of water resources are being used in food production. By 2020, demand is expected to have grown by 40%, requiring 17% more water just to produce food.

Furthermore, she explained that improved seeds, genetic uniformity, pesticides, chemical fertilizers, and technological packages, coupled with land degradation, salinisation in irrigation areas, excessive extraction of groundwater, and increased resistance to pests and diseases, have become part of the legacy of the Green Revolution.

The speaker stated that between 2020 and 2080, the Central American region will experience sharp increases in temperature (1.1°C to 5°C). In addition, rainfall will be reduced by 50% in the dry corridor located in the Pacific side of the region and new biophysical conditions will exist in terms of temperature, humidity, precipitation, wind, and atmospheric pressure, which will have a direct effect on agriculture and food production.

The Costa Rica Minister of Agriculture and Livestock presented her country's "Agri-food Sector and Rural Development Policy", which is illustrated in Figure 1. This figure shows a cross-institutional alignment that includes competitiveness, innovation and technological development, rural area management and family farming, as well as climate change and agri-environmental management.

In this policy, water resources cut across components and are considered resources that go beyond irrigation and drainage infrastructure aspects. Within this context, the Minister emphasized that the water issue should be linked to research, development, and technology transfer.

Figure 1. State of the Agri-food Sector and Rural Development Policy



In terms of the competitiveness component, this includes infrastructure to support production, financing, and insurance for agri-food development, which includes several projects that seek comprehensive management of water resources, flood control, improvement of the Arenal-Tempisque irrigation district, the construction of reservoirs, and small irrigation and drainage works.

The innovation and technological development components encompass research and innovation that includes research and transfer, training and instruction to productive agents, and capacity building for innovation, all of which will be developed through research and technological development programmes, technology transfer, technical assistance and extension, and also by strengthening training programs for producers and staff or management teams from agro-industrial companies.

For its part, rural areas management and family farming components include improving the economy in rural areas as well as family farming (by strengthening the social fabric and local cooperation networks), promoting agri-eco-business to encourage environmental protection technologies and optimum use of natural resources, and differentiated technical assistance and training in good agricultural practices and small-scale irrigation.

Finally, agri-environmental management and climate change components include the mitigation of the effects of climate change and compensation to sustainable production. Two programmes have been structured to do this. The first will consist of economic incentives programmes for mitigation of CO2 emissions produced by the agri-food sector (SAF-CAFÉ and NAMA's, under construction). The second one is recognition for Environmental Services program for the agri-food sector - Recognition of Environmental Benefits (RBA).

At the end of her presentation, Gloria Abraham spoke about the challenges for the agri-food sector.

Particularly in terms of water resource management, she raised the need to go beyond irrigation and drainage infrastructure. She spoke of challenges such as promoting rational and efficient use of water

resources, the need to link irrigation with the development of precision and controlled-environment agriculture, and investigating and validating irrigation technology in traditional and non-traditional agriculture.

Additionally, other challenges mentioned were capacity building and technical assistance in irrigation and drainage, rethinking organization and management regarding water use in agriculture, continued support to investments in irrigation and drainage, and improved efficiency in water use and tariff systems.

The final challenge the Minister shared in her presentation was strengthening intra and inter-sectoral articulation between national institutions, as well as creating partnerships in order to be able to work jointly.



Family farming on the hillsides of Chiriqui, Panama. Foto: CC by Lon&Queta on Flickr

## >Keynote presentation

### Water Security: Essential for Meeting the Challenge of Feeding 9 Billion People

Mohamed Ait-Kadi, Chair of the GWP Technical Committee

“A more water secure world” This was the phrase with which Mohamed Ait Kadi began his keynote presentation. He was referring to the fact that since 1992, 80% of countries have embarked on reforms to improve the enabling environment for water resources management based on the application of integrated approaches as stated in Agenda 21 and affirmed in the Johannesburg Plan of Implementation.

To Ait-Kadi, the 21st century presents a changing and less predictable world, as there are and will be profound changes in price relativities with much local variability, e.g. in higher oil and other raw materials prices.

Water will become scarcer and more costly in many places. There will be greater competition over land and its use, as well as an even more unpredictable climate. Therefore, in the future there will be growing dependence on what can be grown and for what purpose. The debate will be about food, feed, fibre, and fuel.

Within this context, however, what has not changed is the need to feed the population – which is estimated to reach around 9 billion by 2050 – to which changing diets must be added. Therefore, the challenge is achieving a balance between food demand and supply sustainability.

To achieve food security, it is necessary to consider a number of interconnected risks that have to do with geopolitical, economic, social, and environmental factors. For example, environmental hazards should include biodiversity loss, water scarcity, and extreme weather.

One obvious factor is that problems cannot be solved by countries acting in isolation, since international market elements must be considered which relate to, for example, the price of commodities, such as corn, rice, wheat, oil, etc. Some countries have already launched a number of policies in response to the food crisis. Examples include trade restrictions on certain products, consumer subsidies, or increased supply.

Another element that should be taken into account to ensure food supply in some countries is “land grabbing”. In this context, developed countries and multi-national companies are buying up land in developing countries in Africa and Asia.

In the speaker's opinion, the volatility seen in food prices in 2008 should be treated as a warning sign of things to come.

It is an age of consequences, where increasing food insecurity will generate more competition over water resources. Migration will cause supply problems in urban areas and State failures will cause international conflicts.

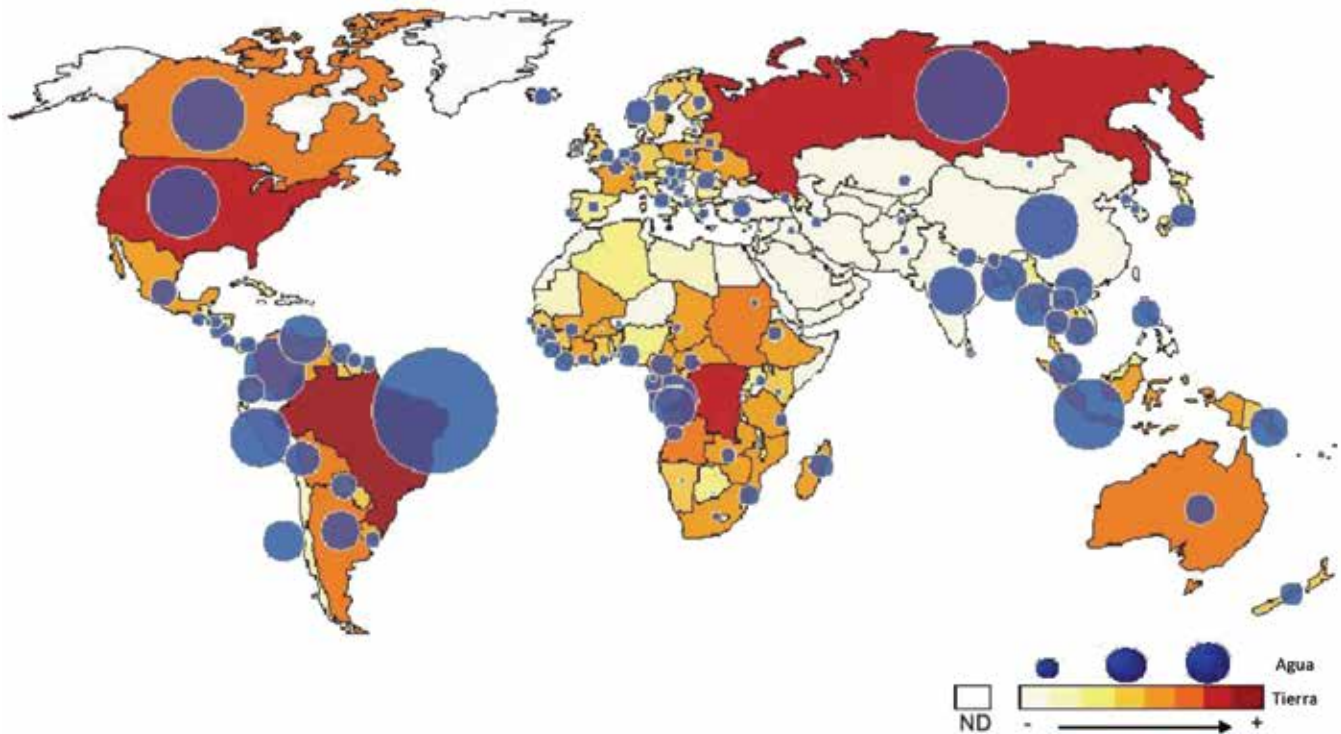
Thus the question is about whether food supplies will be able to keep up with growing demand. Regarding this fact, it was mentioned that demand drivers are well understood. However, there is growing uncertainty and risk on the supply side. Some of the elements that need to be taken into account when analysing both aspects are listed in the following table.

Drivers of demand are well known	Increased risks and uncertainty on the supply side
Population growth	Limits to land, water, biodiversity and soil.
Income growth	Slowing productivity growth
Urbanization	Stagnant investment levels in research and development
Shift in food preferences	Energy prices
Biofuels	Increased risks and uncertainty from climate change and variability
Processed foods	Interlinked international markets (globalization, information, standards and supermarkets)

Source: Mohamed Ait-Kadi

Key threats to global food supply are the growing scarcity of water and land, increased water and land inelasticity, declining agricultural productivity, and threats to agriculture imposed by climate change.

### Available Land and Water



*Note: Area harvested in 2004. Arable land in equivalent potential. Source: FAO, Land Resource Potential and Constraints at Regional and Country Level (2000); FAO (2007). Elaboration ICONE. Map generated by Philcarto*

The per capita availability of water at regional and global levels is declining: This is associated with population growth and resource degradation. For example, during the 20th century population grew three-fold while water use grew six-fold.

Rivers are being overtaxed, said Ait-Kadi, while groundwater is being abstracted at unsustainable rates. In addition, 10% of the world's grain production depends on unsustainable aquifer withdrawals.

The speaker stressed that food self-sufficiency is not a viable option. He mentioned, for example, that China will become one of the major importers of food, as well as Western Asia and North Africa. Latin American countries such as Brazil and Argentina will become major exporters. However, they will be facing significant ecological risks. Canada and Russia could benefit from climate change and increase their export capacity, and so too could the United States of America and Europe but not in noticeable proportions.

Another key threat to global food supply is the increasing inelasticity of water and land, which is generated by changes in the agricultural sector. Many governments have established mandates that indicate the amount of biofuel that must be produced, without considering food or fuel prices.

According to OECD/FAO (2011) projections, biofuel production will more than double during the 2007/09 to 2019 period and demand will increase four-fold between 2008 and 2035 (IEA, 2010). In addition, predictions state that support for biofuels will increase from US\$20 billion in 2009 to \$65 billion in 2035. At the same time, the environmental benefits of biofuel production are being contested. (Al Riffai, Dimaranan, and Laborde, 2010a; Laborde 2011)

In the United States of America, maize production has increased, but about 35% is used for biofuel production.

Declining agricultural productivity is also one of the key elements affecting food supply. This is caused, among other factors, by the decapitalisation of agriculture, which reduces agricultural research and loans for irrigation infrastructure. For example, there was a 2% increase in productivity during the 1970-1990 period, and a 1.1% increase during the 1990-2007 period. In addition, it is projected that productivity will increase by 0.8% during the 2007-2014 period.

Threats to agriculture imposed by climate change relate to the increasing frequency and intensity of floods and droughts. Therefore, it is necessary to understand the complex relationship between climate, land and water use, surface and groundwater flows, and how the system is fed back to be able to meet the demand. The risks associated with climate change will have an impact on agricultural production. This can be seen in the following table:

Expected impact on agricultural production potential  
(% change 1961-90 compared to 2070-90)

	Without carbon fertilization (%)	With carbon fertilization (%)
World	-15.9	-3.2
Industrialized countries	-6.3	7.7
Developing countries	-19.7	-7.7
Middle East/North Africa	-21.2	-9.4
Morocco	-39.0	-29.9

Source: Cline 2007.

Extreme climatic events played an important role in a decrease in production of some key crops during the 2007-2008 and 2010-2011 periods.

Within this context, the speaker remarked that food security will deteriorate in all four of its dimensions: availability, access, stability, and quality.

In conclusion, he said that in the long term (2050) global food abundance is not totally guaranteed, but there is no reason to announce prophetic famines. However, constraints – such as a reduction in available land, water scarcity, increased risk of natural disasters, and loss of biodiversity and social responsiveness – are so important that we would have to consider the potential risk of temporary food shortages and a long-term increase in food prices.

Threats to agriculture imposed by climate change relate to the increasing frequency and intensity of floods and droughts.

Aid-Kadi subsequently suggested a new equation for producing more food which takes into account higher yields in all kinds of agriculture, (mainly that which is poor), higher input prices, climate change, the need to adapt to water scarcity, floods and droughts and, in addition, the responsibility of being environmentally friendly and ensuring better food prices.

There must, therefore, be three key priorities for action.

1. More food must be produced sustainably through better water management, the spread and implementation of existing knowledge, technology and best practices, and by investments in new

science and technology and in rural and social infrastructure that enable farmers to benefit from all of these.

2. Political and economic governance of water and food systems, at both national and international levels, should be improved to increase productivity and sustainability.
3. Agricultural barriers should be eliminated, including the elimination of biofuel subsidies.



The farmer's market in Tegucigalpa, Honduras.

## Food and Nutrition Security in Central America and the Dominican Republic: Trends and Challenges

Jose Emilio Saudi H., Representative of the United Nations Food and Agriculture Organization (FAO) in Costa Rica.

“Food and nutrition security exists when all people, at all times, have physical, social and economic access to healthy and nutritious food that meets their dietary needs and food preferences for an active and healthy life.” Opening words from Jose Emilio Saudi, FAO representative in Costa Rica.

Food security areas relate to access, availability, stability, and biological utilization.

Within the context of food security, there is a shortage of food in Central America. This, coupled with deficiencies in education, in nutritional and hygiene practices, in access to health, excessive consumption of certain foods and morbidity, leads to malnutrition and death among Central Americans, either by malnutrition, excess weight or obesity.

In terms of inadequate food intake, the speaker cited statistics on malnutrition among children under five (low weight/age), according to which Guatemala has a 23% rate, Honduras 8%, Nicaragua and El Salvador 6%, Costa Rica 5%, and Panama and the Caribbean 4%.



Percentages for moderate or severe chronic malnutrition (low height/age) in children under 5 are as follows: Guatemala 49%, Honduras 29%, Nicaragua 22%, El Salvador 19%, Panama 19%, and Costa Rica 6%.

Saudi asked the question of whether there was sufficient food in Central America. His answer was that in all countries in the region the availability of food exceeds the minimum requirement of 2,200 kcal/capita. The following table refers to this fact:

#### Amount of Kcal/capita available in each Central American country

Country	Kcal/day
Costa Rica	2.840
El Salvador	2.590
Guatemala	2.159
Honduras	2.623
Nicaragua	2.403
Panama	2.484

Source: (FAOSTAT 2012; 2007 data)

However, despite the existence of sufficient food in the Central American region, not all people have access to the same amount of food because it is unevenly available both in quality and quantity. For example, 14.2% of Central Americans are malnourished, which is equivalent to almost six million people.

Undernourishment rates indicate the proportion of people with inadequate energy intake. In general, Central America has an undernourishment rate of 14.2%, which is five percentage points above the average for Latin America and the Caribbean (9%). In terms of the percentage of undernourished people, data from 2006 and 2008 show the following figures: Guatemala 22%, Nicaragua 19%, Panama 15%, Honduras 12%, El Salvador 9% and Costa Rica 0%.

Even though Panama is the country with the highest GDP per capita in Central America (US\$6,972 in 2009), it is the third highest in terms of percentage of undernourished people behind Nicaragua (GDP US\$ 1,070) and Honduras (GDP US\$1,916) (ECLAC, 2010).

Another aspect that should be noted in the case of Central America is the fact that the cereals balance is negative, resulting in a reliance on imports that causes vulnerability in rising international prices scenarios.

#### Central America: Percentage of cereal import relative to the total availability

Country	%
Belize	31
Costa Rica	97
El Salvador	58
Guatemala	56
Honduras	47
Nicaragua	40
Panamá	76

Source: Prepared in-house from FAO Balance Sheets

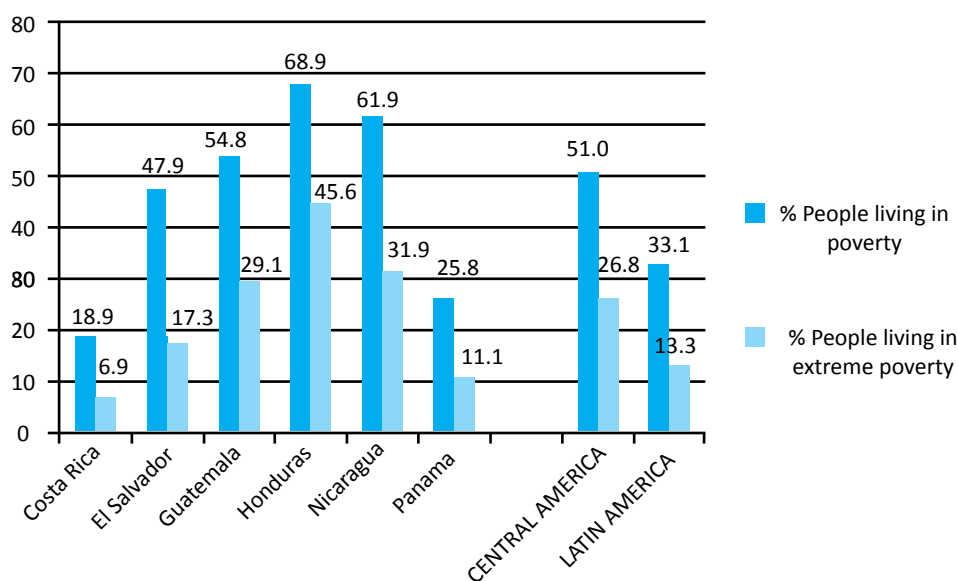
Regarding household food security, the main mechanisms used to procure food for the home are the food markets, which are strongly concentrated, geographically speaking, and control the entire chain. At the same time, difficult access to some rural areas makes it almost impossible for rural residents to get to local fairs and markets.

In general, Central America has an undernourishment rate of 14.2%, which is five percentage points above the average for Latin America and the Caribbean (9%).

Sufficient income or economic access to food is related to purchasing power (level of income and food prices), to the labour market, whether formal or informal, to minimum wages and social security, and to the food culture, which has to do with spending on healthy food versus expensive food, and percentage of food-related expenses.

Within this context, a key factor is access to food, which ultimately is directly related to the population's level of poverty.

Percentage of people living in poverty and extreme poverty



Source: ECLAC. Reference years are: for poverty, 2009; for extreme poverty, 2009 (Costa Rica, El Salvador and Panama), 2007 (Honduras and Nicaragua), and 2006 (Guatemala).

Saudi also expressed that social protection systems can help fulfil the right to food in that part of the population that cannot access food on its own. He added that progress has been made in the development of systems and programs for conditional cash transfers, but improvements still need to be made in terms of coverage and transparency.

*“These programs can break the perpetuation of the poverty cycle, as they address malnutrition and schooling during the first years of life”,* said Saudi. Furthermore, he believes that these programs are the basis for other development actions, because in his opinion, it is illogical to propose capacity building policies if people are still thinking about their daily survival.

Regarding education, nutritional practices and excessive consumption of certain foods, the Central American diet consists of high energy-dense food, but with low nutritional density. The contribution of carbohydrates to the dietary energy supply varies between 64% in Panama and 70% in Guatemala. Proteins only contribute 11% of calories, far less than the 15% recommended. (Sustainable Human Development Status in the Region, 2008)

According to data collected by the Strategic Food Security Project (PESA), poor rural families do not consume more than nine different foods during the week, among them corn, beans, sugar, oil, rice,

coffee, bread or biscuits, eggs, and vegetables for sauces and seasoning. These data were obtained from a sample of 1,328 families in 2007.

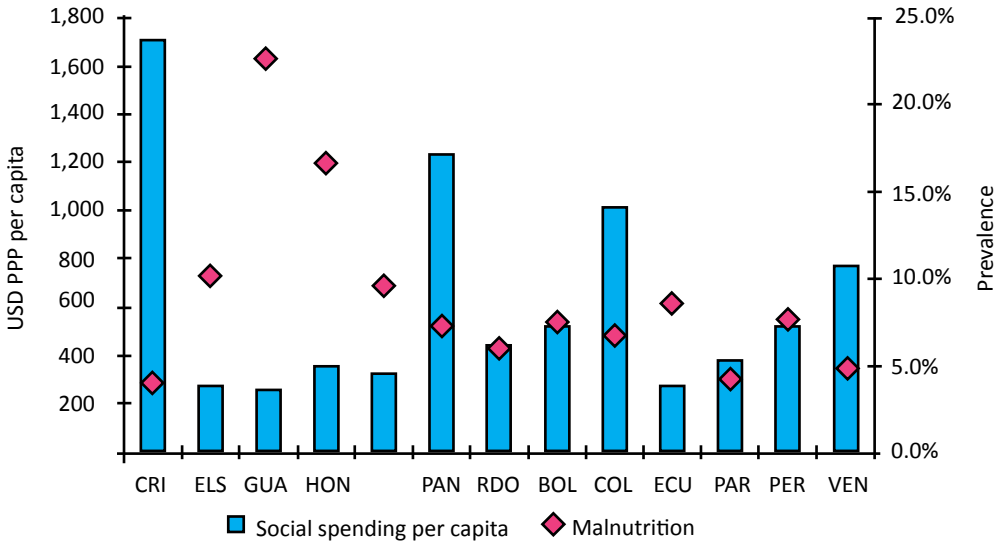
The poor diet of Central Americans is due not only to production or access problems, but to factors such as education and culture, the status of women and belonging to a certain ethnic group, among others. The role of women is highlighted here, because according to studies, the higher the educational level of the mother, the lower the prevalence of chronic malnutrition.

The Central American diet, whether poor or unbalanced, is wreaking havoc on health. For example, there is an increase in the incidence of obesity, excessive weight and other conditions associated with lifestyle. In this context, Costa Rica presents the highest levels in the region, where approximately 9% of children, under five years, are overweight. This situation is increasingly affecting disadvantaged sectors.

The FAO representative also stressed issues that tend to be forgotten in the Central American context. For example, he mentioned population growth, which is high in some rural areas. Within this context, he said that the indigenous populations exceed 7.5 million people, representing 18% of all Central Americans, and 73% of them live in Guatemala. He also emphasized that inequalities still persist between populations in the region based on gender, ethnicity, and place of residence.

*“Without revenue there is no social investment, and without it, malnutrition tends to persist”*, confirmed the speaker when explaining that Central and South American countries with the highest malnutrition rates allocated an average of US \$298 per capita per year to social spending, and that countries that allocate greater resources to social spending have the lowest malnutrition rates.

**Latin America (13 countries): Overall malnutrition and social spending per capita (2003 – 2005)**



Source: ECLAC, data base from social spending and last national nutrition survey available in each country.

- Jose Emilio Saudi raised the following challenges:
- Greater production: sustainable intensification
  - Preparing to tackle climate change and natural disasters.
  - Protecting resources (conservation agriculture)

- Reusing and recycling
- Reducing waste and food loss
- Improving the integration of different production systems.
- Choosing sustainable and healthy diets

He also stressed that by 2050 the population is expected to reach 9 billion, and that it will be necessary to increase food production by 60% to feed all, which must be done by increasing agricultural productivity, arable land, and cropping intensity. To meet this demand, at least 10% more water will be required.

He also expressed that the increase in prices should be placed on the Food and Nutrition Security's (FNS) political agenda.

He concluded by saying that State policies should consider the instability of purchasing power (food basket) and the need to redefine their priorities in terms of the amount of food, the nutritious quality thereof, changing consumption patterns, and financing for education. Agri-food markets must become more transparent and local markets more dynamic.



Celaque National Park in Honduras.

## Cooperation Programme on Agriculture and Irrigation for Mexico, Central America and Dominican Republic

Diego Montenegro, Coordinator for Central America and representative of the Inter-American Institute for Cooperation on Agriculture (IICA) in Costa Rica

**T**he speaker began by explaining the origin of the Cooperation Programme on Agriculture and Irrigation for Mexico, Central America, and Dominican Republic.

The commitment to create the programme originated in 2009 during presidential agreements and at the same time during a consultation between Ministers of Agriculture from Mexico and Central America. Subsequently, FAO produced a proposal for a technical cooperation programme for the

region. In view of this, the Ministers of the Central American Agricultural Council (CAC) requested FAO and the Inter-American Institute on Agricultural Co-operation (IICA), to work together to attract resources and set up a regional programme on irrigation and drainage.

The programme's proposal was the result of a consultation process conducted in all Central American countries, the Dominican Republic and Mexico. This consultation helped to identify the countries' needs and possible offers by Mexican institutions.

The objectives of this programme are to contribute to increasing knowledge, attitudes, and management capacity, and to implement the most appropriate policies for agriculture under irrigation in Central America and the Dominican Republic. In addition, this programme aims to build capacity in the Government sector, organizations within the production sector (farmers and businesses), as well as in college and technical education organizations.

In terms of strategic guidelines, the programme will especially consider the following two aspects:

- Focusing especially on the needs of smaller-scale producers and those most vulnerable to risks associated with climate change.
- Considering the technological constraints that small producers face when producing staple crops.

Among the thematic areas that interest countries: strategies and policies for irrigation agriculture, inter-agency cooperation, technology research and recovery programme, incentives for private investment in irrigation agriculture, information systems, and motivation for using irrigation and drainage to adapt to climate change, developing curricula and training for teachers in technology, water management in universities and technical schools, and training for technical personnel for on-farm water management, with renewed efficiency criteria.

Montenegro said that actions for implementing the programme include internships, postgraduate training, tours for Central American and Dominican Republic technicians to Mexico, development of courses in the countries, advice from Mexican institutions to Central American and Dominican institutions, the creation of cooperation and exchange networks involving technicians from the aforementioned countries, forums and fairs with participation from private actors to encourage private investment and the IICA scholarship program in conjunction with the Mexican academic sector.

Mexico's obvious experience becomes a valuable contribution to Central American countries and the Dominican Republic, so Montenegro described some noteworthy aspects of the Mexican experience. Mexico, for example, has 6.4 million hectares under irrigation, which is the result of a State policy in place for many years which has allowed competitive agriculture that generates income and that has multiplier effects in rural economies. He added that more than 200,000 producers have benefited.

He also mentioned that the programme's institutional framework is linked to guidelines emanating from CAC, within the framework of PACA, the Central American Integration of Agricultural Technology (SICTA) and the Regional Agri-environmental and Health Strategy (ERAS). Moreover, actions at the national level are related to policies, national food programmes and other related programs.

In this program, IICA has a role as regional and country coordinator. Its offices will be responsible for creating the national multidisciplinary technical teams in charge, which will be the counterpart of Mexican institutions and will have support from IICA representatives in the countries. It will also generate a proposal document for regional and national strategies for agriculture under irrigation, and will explain the scope thereof to national authorities.

The objectives of this programme are to contribute to increasing knowledge, attitudes, and management capacity, and to implement the most appropriate policies for agriculture under irrigation in Central America and the Dominican Republic.

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National technical teams must include the countries' respective Ministries of Agriculture, national entities responsible for irrigation and drainage, national agricultural technology institutes, leading universities in the field of irrigation, and organizations from the agricultural private sector. An IICA technician will act as facilitator for these technical teams.

Finally, the following conditions and commitments were established for future regional irrigation programs:

- Raising awareness regarding agriculture under irrigation as prevention and adaptation to climate change among Central American and Dominican private and public sector organizations.
- The promotion of institutional reforms.
- CAC support to planned actions and support from the Ministries of Agriculture, Environment and Planning, among others, of every country involved.
- Complementarity with other regional projects and the promotion of cooperation relationships with other aid agencies such as FAO, TCP Riego and the PESA project.



Central American family in their cornfield.

## Food Security Policies at Regional Levels and Their Relationship to Water Management

Manuel Jimenez, specialist from the Central American Agricultural Council (CAC)

The origin of regional actions in Food and Nutrition Security (FNS) and water resources was the first topic addressed by Manuel Jimenez, who spoke about the presidential mandates, cross-sectoral agreements, ministerial agreements, strategies and policies, and work plans of the CAC pro tempore presidency.

In terms of the regional strategies of the Central American Agricultural Council (CAC), he cited examples such as the 2007 Central American Agricultural Policy (PACA), the 2008 Regional Agri-environmental and Health Strategy (ERAS), the 2010 Central American Strategy for Rural Territorial Development (ECADERT), the 2011 Regional Fruit-growing Development Policy (POR-FRUTAS), and the 2012 Central America and Dominican Republic Food security and Nutrition Policy.

As for water resources, Jimenez spoke of the 2003 inter-ministerial agreement between CAC and the Central American Commission on Environment and Development (CCAD), which called for the formulation of the Central American Integrated Water Resources Management Strategy (ECAGIRH).

At that time, it was agreed to ask CCAD and CAC ministries to develop a proposal to prepare a regional strategy for integrated management of water resources, which was to be carried out with support from the Regional Water Resources Committee (CRRH), the Tropical Agronomic Research and Education Centre (CATIE), the Global Water Partnership (GWP), and other specialized agencies,

The speaker also spoke about how sustainable water use and management are present in various regional policies and strategies. He expressed that ERAS promotes technological innovation initiatives that focus on sustainable water use and management, as well as soil and water management and conservation at different levels (watershed, farm, etc.). It also promotes strengthening good production practices that contribute to preventing pollution or deterioration in the quality and availability of water for different uses.

ECADERT promotes initiatives such as rural businesses - linked to environmental conservation - including production and protection of water sources, animal breeding facilities and environmental services.

Specifically, in terms of irrigation and drainage, PACA mentions the modernization of private services aimed at the agricultural sector, including irrigation; ERAS mentions the development, validation, spread and transfer of technologies for efficient water use in production activities and in animal and human use.

ECADERT's work includes creating favourable conditions for the development of the territories' production through the improvement of infrastructure and support services for the rural economy by the States, e.g. the production infrastructure that supports economic activities, such as wells and other water sources, and irrigation and drainage systems.

POR-FRUTAS contains initiatives for efficient and sustainable water use in small scale irrigation for fruit growing activities.

Jimenez continued his presentation speaking about regulations, which he defined as the establishment of standards and mechanisms that encourage the sustainable management of shared and transboundary watersheds, as well as promote policy regulations or guidelines to regulate land and water markets, as expressed by ECADERT.

The Food and Nutrition Security Policy for Central America and the Dominican Republic mentions the issue of water for human use and its relationship to FNS. In this regard, Jimenez explained the following points:

- Promotion of health conditions that facilitate permanent access to sanitation and safe food, which reduces infections.
- Promotion of technologies for collecting and treating water for human consumption and for wastewater management, with a gender equality and equity approach.
- Promotion of safe water use and management in the home, including hand washing, which decreases the incidence and prevalence of water- and food-borne diseases.

The speaker also stressed the issue of risk management related to hydro-meteorological events and FNS. In this regard, he expressed that transitory food insecurity is relatively unpredictable and may

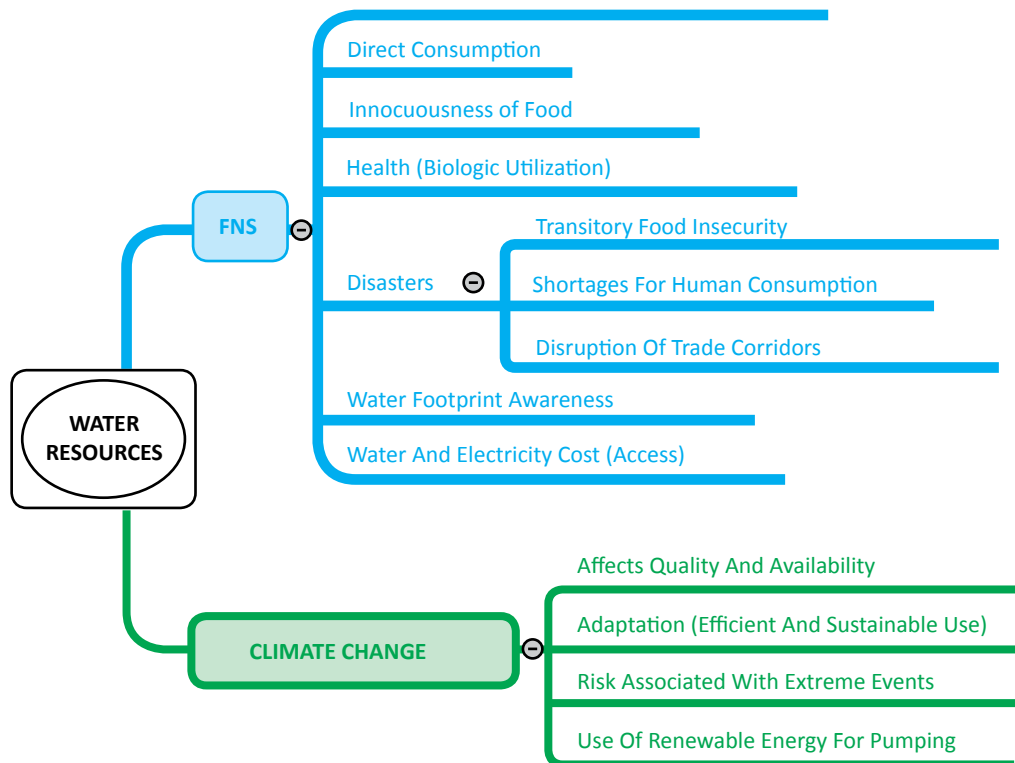
Chronic food insecurity is that which is long term or persistent, while transitory food insecurity occurs in the short term and is temporary

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occur suddenly. Chronic food insecurity is that which is long term or persistent, while transitory food insecurity occurs in the short term and is temporary.

For risk management, regional policies and strategies suggest strengthening regional and national capacity for generating early weather alerts and having specialized forecasts for agriculture, health and the environment; the development of agro-climatic information subsystems within the SIC-Agro framework; capacity-building for response and recovery, with emphasis on measuring loss or damage; vulnerabilities analysis; and strengthening public and private capacity for monitoring and evaluating the impact of climate change on seas and inland bodies of water and its effect on the distribution and abundance of hydro-biological resources.

### Basic relationships between water, climate change, and food and nutrition security



Source: Manuel Jimenez, CAC. 2012

The CAC representative ended his presentation by sharing the following thoughts:

- Agriculture is the main user of water resources in the region.
- Irrigation, including small-scale and water harvesting, helps adapt to climate change and promotes FNS.
- Water resources, although part of the solution, are seriously threatened by climate change, which could possibly affect the quantity, quality and geographic and temporal distribution thereof.
- Soil and water management is a challenge for technological innovation in SICA countries.
- Sustainable and efficient water use, as part of comprehensive water resources management, is present in all policies and strategies adopted by CAC, thus ratifying its vital role in agricultural and rural development.





Evidence of drought in the river Guayape in Honduras. Photo: Ana Jimenez

## Climate Predictions and Food and Nutrition Security

Patricia Ramirez, Executive Secretary of the Regional Committee on Water Resources (CRRH-SICA)

**A**t the beginning of her presentation, Patricia Ramirez explained that climate is a key variable in sustainable food production, water availability and the management of resources related to plants, animals and soil.

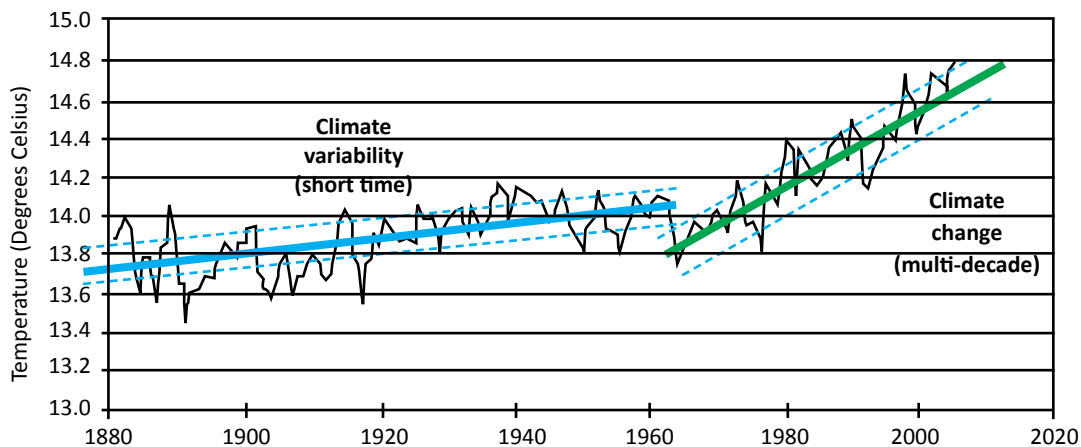
Food and water security is related to climate, not only because it constitutes a natural hazard, but because it is a usable resource.

There are climatic risks for water and food security, both short-and long-term. In the short term, we have climate variability, with its seasonal, intra-seasonal and inter-annual fluctuations. In the long term, we have climate change showing ten-year trends or changes.

Regarding climate risk management, Ramirez stated that analyses and predictions are being used by sectors responsible for food availability and safety to manage climate risk in FNS.

This information can in turn be used by communities to adopt prevention and mitigation measures in production activities, in drinking water supply and in health and risk management during extreme events.

### Trend for average global temperature change between 1880 and 2005



Source: Goddard Institute for Space Studies

... it is necessary to determine each production system's critical threshold, the one beyond which systems may become vulnerable after suffering the impact of a climate event.

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According to the above table, the speaker explained that the trend of change in average temperature and precipitation values became apparent during the 20th century, and that change rate increased from mid-century.

She explained that the fourth report of the Intergovernmental Panel on Climate Change (IPCC) mentions that an increase in inter-annual climate variability is to be expected. She added that these changes will become apparent in the water cycle, affecting food production and the availability of water for human consumption and irrigation. Changes in the probability distribution of events are a manifestation of changes in climate variability. Mean values shift, changes uncertain.

Ramirez explained that it is necessary to determine each production system's critical threshold, the one beyond which systems may become vulnerable after suffering the impact of a climate event, i.e., it is necessary to determine the tolerance range in relation to risk space.

Central America needs to strengthen its capacity and maintain and follow up on climate monitoring, observation and prediction systems. It also needs to maintain and continually update its data bases and increase efforts to correlate sectoral indicators with climatic variables in order to improve specific climate services for stakeholders.

In order to contribute to the process of generating relevant information at the national and regional levels, CRRH-SICA is working on the Central America Climate Database Project (BDCAC), through which the Central America Centre for Meteorological and Hydrological Integration (CIMHAC) operates, which integrates countries and processes under one single action.

CIMHAC aims to integrate the capacity of Meteorological Services of Mexico, Central America, Colombia and the Dominican Republic to improve the range of Information Services that help reduce climate risk - under the Central American isthmus hydrometeorological scheme - and to respond to extreme weather events by using the most advanced satellite products.

Finally, Ramirez shared information regarding the 37th Central America Climate Forum, which presented weather predictions for August to October 2012. This is an initiative that has been conducted for several years and where representatives of various sectors are expected to participate so that climatic variables can be analysed as a tool for climate risk management.



Photo: CC by Lon&Queta in Flickr

## Actions for Food and Water Security in Central America: Progress and Challenges

Bernal Soto, Executive Director for the National Irrigation and Drainage Service (SENARA), Costa Rica

**B**ernal Soto began his presentation by mentioning that water security is necessary for achieving food security and achieving, in a more appropriate manner, the mitigation of the adverse effects of climate change and adaptation to this phenomenon.

In the speaker's opinion, water security for agriculture is essential, because less water means less productivity and a negative effect on food quality. Food prices will be affected as the cost of production is related to water availability.

Within this context, he also mentioned that in order to achieve food security, we need to produce food properly, safely and fairly, so we need the capacity to produce (or buy), store and distribute the necessary amounts and at appropriate prices so that most of the population is able to eat.

As for the effects of climate change on agriculture, Soto said that these cause a decrease in cultivation areas and hence the need to adapt them to face the new climatic conditions; the availability of fresh water is reduced and environmental conditions are altered, as is the quality of the air.

The SENARA representative made references to the following tables which detail water supply and demand and highlight agriculture as one of the main activities using water in Central America.

**40% of global food supplies are grown on irrigated land, which makes irrigation an extremely important factor in global food security**

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## Water supply and demand in Central American countries

Country	SUPPLY (Mm <sup>3</sup> /yr)	SUPPLY (m <sup>3</sup> /per capita)	DEMAND (Mm <sup>3</sup> /año)	USE
Panama	193.500	59.985	12.500	< 7% OT
Costa Rica	113.100	24.784	23.500	20,73% OT
Nicaragua	189.700	34.500	1.956	1,03% OT
Honduras	92.850	11.540	8.450	±9,1% OT
El Salvador	18.252	<b>3.177</b>	1.844	<b>10,1% OT</b>
Guatemala	97.120	6.900	9.596	<b>9,88% OT</b>
Belice	18.550	53.156	568	3% OT
<b>TOTAL</b>	<b>723.072</b>		<b>58.414</b>	<b>8% OT</b>

Supply in all countries exceeds the water deficit reference value (1700 m<sup>3</sup>/capita/year); most use less than 10% of their available resources; spatial and temporal precipitation distribution and lack of regulation works. SOURCE: Status of Water Resources in Central America: Towards Integrated Management. GWP Central America, 2011

## Main water use in Central American countries

Country	NON CONSUMPTIVE USE		CONSUMPTIVE USE			
	Inter-oceanic navigation	Hydroelectric generation	Irrigation	Industry	Human supply	Others
Panama	20%	72%	44%		56%	
Costa Rica (*)		94%	65%	33%	2%	
Nicaragua		25%	80%		20%	
Honduras			61%	6%	17%	16%
El Salvador			85%		15%	
Guatemala			70%		15%	15%
Belice			44%	36%	20%	

(\*) Irrigation includes 16% for agricultural use and Industry includes 19% for agro-industrial use. SOURCE: Status of Water Resources in Central America: Towards Integrated Management. GWP Central America, 2011

Based on FAO data, Soto said that irrigation is growing steadily worldwide; 40% of global food supplies are grown on irrigated land, which makes irrigation an extremely important factor in global food security.

He also mentioned that to meet future food needs of rapidly growing populations, irrigated agriculture will have to increase approximately by 4% per year.

In terms of climate change, water resources and agriculture, the speaker stated that consequences of the effects of climate change on agriculture will involve an increase in land input costs, possible increases in Greenhouse Gas (GHG) emissions, conflicts over water use, increased production costs, physiological changes, biodiversity loss, increased pests and diseases, as well as revaluation of animal systems and the establishment of zero burning policies.

Necessary mitigation and adaptation measures include increased planting density, generation of materials, efficient mechanization, efficient adaptation methods, drought-tolerant materials, efficient water use, watershed conservation, efficient "technification", knowledge of materials, higher photosynthetic efficiency, precision agriculture, genebanks, efficient preparation systems and mechanized harvest systems.

Regarding Costa Rica specifically, Soto expressed that the country can irrigate 430,000 ha, considering soil capacity, available water supply, and moisture deficit (MAI Index). This would enable land for the development of agricultural activities by implementing drainage works in 300,000 ha, i.e. 15% of the 5.11 million ha that the country has.

The Arenal Water System is located in the Guanacaste area, and is part of the Arenal-Tempisque Irrigation District (DRAT). Soto stated that one-third of the country's hydroelectric energy is produced by the Arenal-Dengo-Sandillal Hydroelectric Complex (ICE, 372 MW), which has an annual volume of 1,500 m<sup>3</sup> of water passing through its turbines, with the added value that two-thirds is available during the dry season.

Part of this water resource is tapped by DRAT for hydroproductive ends, such as water for irrigating close to 28,000 ha, and fish farming, approximately 700 ha.

### Arenal-Tempisque Irrigation District



Source: SENARA

As a new horizon for water use, the speaker spoke of various concepts. First, he spoke of the concept of equilibrium, understood as the need to seek a balance between the supply and demand of water. Secondly, he introduced the concept of human development, which relates to the fair fulfilment of the population's needs and their various activities. Thirdly, he mentioned the concept of efficiency, which seeks to avoid wasting water. Fourthly, he cited the concept of sustainability, which means preventing the deterioration of water resource quality so that future generations can utilize it. Finally, he referred to the concept of localization, which has to do with the simultaneous use of surface and groundwater, soil and aquatic ecosystems, under the criterion of watershed aquifers.

At the end of his presentation, the speaker mentioned that there were numerous predictions concerning the coming water crisis, which range from its scarcity and rising prices to the emergence of political conflicts that could limit the possibility of functioning properly as a society.

Within this context, there will also be an economic impact due to water scarcity, which will be reflected on growth in general, on trade patterns and volume, and on general welfare.

However, he believes that by being aware of the reality (as well as of renewable energy), water consumption at a certain level can be sustained. There are very few countries that have a lot of water, like for example, Costa Rica, but its scarcity will lead to the establishment of actual costs, will redefine competitive advantages and relocate industries.



The production of tilapia in the Arenal–Tempisque Irrigation District (DRAT) in Costa Rica. Photo: Tilapia del Sol

## Aquaculture Industries in the Arenal-Tempisque Irrigation District (DRAT)

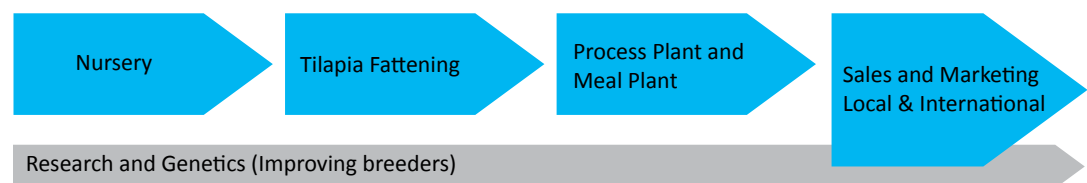
Walter Cruz, Administrative Manager, Tilapias del Sol

This presentation aimed to share work experience within the Arenal - Tempisque Irrigation District (DRAT) in Costa Rica.

The speaker commented that tilapia production started in 1986, with support from the Ministry of Agriculture and Livestock (MAG), through SENARA and INCOPESCA.

This activity is conducted in the Guanacaste area because of the favourable agro-ecological conditions for the *Oreochromis niloticus* species. The system used is based on intensive or semi-intensive ponds, and has gone from producing 8,000 tonnes/year in 2000 to approximately 20,000 tonnes in 2012.

Using the following figure, the speaker explained how the industry operates:



Cruz believes that DRAT activities are examples of multiple water resources utilization because the system benefits four sectors - tourism, hydroelectric generation, aquaculture and agriculture. He said that farming makes non-consumptive use of water and the production technology has been adapted to co-exist with other DRAT production activities.

He spoke of the socio-economic benefits of this industry, which generates more than US\$55 million annually in foreign currency, and close to 1,300 direct and stable full time jobs.

In terms of benefits for workers, he mentioned the creation of large amounts of jobs for women, a solidarity association\*, and a company doctor, along with significant opportunities for advancement and job stability. As a future challenge, Cruz mentioned the industry's consolidation.

\* "Solidarism" is conducted within businesses through the establishment of worker associations that seek to promote their own economic and social improvement, not through class struggle, but through harmony and dialogue.



Tegucigalpa, Honduras.

## Governance and Integrated Management of Water Resources in Central America

Maureen Ballestero, Chair of GWP Costa Rica

**T**he GWP representative in Costa Rica mentioned that water governance refers to the range of political, social, economic and administrative systems which are set up to develop and manage water resources and water supply in different levels of society.

Within this context, Ballestero posed the following question: What does water governance mean? She replied that it is society's capacity to direct its energies in a coherent manner towards the sustainable development of its water resources. She added that this concept refers to the capacity for designing and implementing good public policies for proper water management.

She also added that effective governance of water resources requires the joint commitment of Governments and of all society groups, including the private sector, civil society, academia and local groups, among others.

Governance is also based on the formulation of policies and laws and successful planning, as well as on an institutional system that implements those policies and legislation.

The speaker stressed that governance will require a process of decision making, which affects economic, social and environmental activities.

As for the problems that the State and civil society must face to achieve good governance, Ballestero mentioned the following five points:

- The ineffectiveness of the Administration and its inability to meet needs.
- The weakness of the State's regulatory role.
- The weakness of civil society in our countries.
- The public perception that the institutional apparatus has been hijacked and is corrupt.

**Society moves forward when it improves its water legislation, regulates the water and sanitation services, develops the institutional framework for water management, restructures the financial and economic practices and when there is political will to overcome obstacles that oppose change.**

- The presence of new topics (ethnic minorities, third generation rights, environmental sustainability, etc.)

At the end of her presentation, she said that there is no single – much less simple – solution that can guarantee a society its governance, because in her opinion, each one has its own natural conditions, power structures and needs.

However, she believes that a society advances when it improves in terms of water legislation, when public water and sanitation services are regulated, when institutional frameworks are reformed and developed for water management, when financial and economic practices are restructured and when there is a political will to overcome the obstacles that oppose change.

Finally, Ballesterro emphasized the need to put Integrated Water Resources Management (IWRM) into practice in order to move towards good water governance.



## > Conclusions

1. Central American countries and the Dominican Republic have regional policy instruments that seek to guide actions and define key aspects regarding resource use and management – including water resources – for irrigation, agricultural production, and food security.
2. Water is a resource necessary for food security because it influences productivity, food costs, and the land available for agricultural purposes, among other things. Therefore, its integrated management is a fundamental element in strategies that are designed and implemented in the region in the field of food security.



3. Science and technology must be increasingly present within the development of new tools which will enable progress towards food security, as well as in the search for solutions to climate problems that may arise for populations in Central America and the Dominican Republic.
4. Food security depends on a number of factors associated with the international context, for example, the price of oil, the end use of foods, and the occurrence of extreme events. For these reasons, countries cannot be isolated and must work in a coordinated manner to address the challenges.
5. Governments need to find ways to ensure access to food for the poorest and most vulnerable social groups, taking into account elements such as access and nutritional value.
6. Decreasing water availability and inadequate water resources management will not only cause problems for production, but also in terms of markets – increased food prices – therefore limiting access for economically vulnerable groups.
7. Climate is a key variable in sustainable food production and water availability. Actions for adapting to and mitigating climate change should be a priority in order to handle extreme hydro-meteorological events and enable food security and water security.
8. Climate change is having an impact on food security and water security, so climatic variables need to be incorporated into risk management and adaptation strategies, in order to reduce the vulnerability of populations and contribute to food security and water security.
9. Within the framework of risk management and adaptation to climate change, irrigation must be incorporated as a strategy for food security and water security. This requires strengthening institutional and local capacity to ensure efficient and effective irrigation systems use.
10. In Central America, there is a need to generate climate/hydrological information in a systematic way and strengthen the capacity of various sectors to interpret data and how they relate to performance within their own sectors.
11. The agricultural sector must identify risk thresholds in climatic variability to determine the actions to be implemented to reduce vulnerability, manage risk, and contribute to adaptation.
12. Without water security, there can be no Food and Nutrition Security.

## Acronyms

AyA	Instituto Costarricense de Acueductos y Alcantarillados <i>Costa Rican Aqueduct and Sewer Institute</i>	INA	Instituto Nacional de Aprendizaje (Costa Rica) <i>National Training Institute</i>
BDCAC	Base de Datos Climáticos de América Central <i>Central America Climate Database Project</i>	INCOPESCA	Instituto Costarricense de Pesca y Agricultura <i>Costa Rican Fisheries and Agriculture Institute</i>
CAC	Consejo Agropecuario Centroamericano <i>Central American Agricultural Council</i>	INDER	Instituto de Desarrollo Rural (Costa Rica) <i>Rural Development Institute</i>
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza <i>Tropical Agronomic Research and Education Centre</i>	INIFAP	Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (México) <i>National Institute for Forestry, Agriculture and Livestock</i>
CCAD	Comisión Centroamericana de Ambiente y Desarrollo <i>Central American Commission on Environment and Development</i>	INTA	Instituto de Innovación y Transferencia Tecnológica Agropecuaria (México) <i>Livestock Innovation and Technology Transfer Institute</i>
ECLAC	<i>Economic Committee for Latin America and the Caribbean</i>	IPCC	<i>Intergovernmental Panel on Climate Change</i>
CIMHAC	Centro de Integración Meteorológico e Hidrológico de América Central <i>Central America Centre for Meteorological and Hydrological Integration</i>	MAG	Ministerio de Agricultura y Ganadería (Costa Rica) <i>Ministry of Agriculture and Livestock</i>
CRRH	Comité Regional de los Recursos Hídricos <i>Regional Water Resources Committee</i>	MIVAH	Ministerio de Vivienda y Asentamientos Humanos (Costa Rica) <i>Ministry for Housing and Human Settlements</i>
COFUPRO	Coordinadora Nacional de las Fundaciones Produce, A.C. <i>National Coordinator for Produce Foundations, C.A.</i>	NAMAS	<i>Nationally Appropriate Mitigation Actions</i>
DRAT	Distrito de Riego Arenal-Tempisque <i>Arenal-Tempisque Irrigation District</i>	OECD	<i>Organisation for Economic Co-operation and Development</i>
ECADERT	Estrategia Centroamericana de Desarrollo Rural Territorial <i>Central American Strategy for Rural Territorial Development</i>	MDG	<i>Millennium Development Goals</i>
ERAS	Estrategia Regional Agroambiental y de Salud <i>Regional Agri-environmental and Health Strategy</i>	PACA	Política Agrícola Centroamericana <i>Central American Agricultural Policy</i>
ECAGIRH	Estrategia Centroamericana de Gestión Integrada de los Recursos Hídricos <i>Central American Integrated Water Resources Management Strategy</i>	GDP	<i>Gross Domestic Product</i>
FAO	<i>United Nations Food and Agriculture Organization</i>	PROGIRH	Programa de Gestión Integrada de Recursos Hídricos <i>Integrated Water Resources Management Programme</i>
GEI	Gases de Efecto Invernadero <i>Greenhouse Gases</i>	POR-FRUTAS	Política Regional de Desarrollo de la Fruticultura <i>Regional Fruit-growing Development Policy</i>
IWRM	Integrated Water Resource Management	PESA	Proyecto Estratégico de Seguridad Alimentaria <i>Strategic Food Security Project</i>
GWP	<i>Global Water Partnership</i>	RBA	<i>Recognition for Environmental Benefits</i>
IEA	<i>International Energy Agency</i>	SAGARPA	Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (México) <i>Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food</i>
IICA	Instituto Interamericano de Cooperación para la Agricultura <i>Inter-American Institute for Cooperation on Agriculture</i>	FNS	Food and Nutrition Security
ICE	Instituto Costarricense de Electricidad <i>Costa Rican Electricity Institute</i>	SFE	Servicio Fitosanitario del Estado (Costa Rica) <i>State Phytosanitary Service</i>
IDIAF	Instituto Dominicano de Investigaciones Agropecuarias y Forestales <i>Dominican Institute for Agricultural and Forestry Research</i>	SENARA	Servicio Nacional de Riego y Avenamiento (Costa Rica) <i>National Irrigation and Drainage Service</i>
		SENASA	Servicio Nacional de Salud Animal (Costa Rica)
		SICA	Sistema de Integración Centroamericana <i>Central American Integration System</i>
		SIC-Agro	Sistema de Información Especializada del Sector Agroalimentario <i>Agri-food Sector Specialized Information System</i>
		SICTA	Sistema de Integración Centroamericano de Tecnología Agrícola <i>Central American Integration of Agricultural Technology</i>

## Programme

Foro Centroamericano y de República Dominicana  
Seguridad Hídrica y Alimentaria:  
El nexo entre el agua y la producción de alimentos

9 de agosto del 2012, Hotel Radisson, San José, Costa Rica

No.	Hora	Actividad	Participan
	8:00-8:30 am	Inscripción y registro	
1	8:30-8:45	Inauguración <ul style="list-style-type: none"> <li>• Sra. Maureen Ballester, Presidenta de GWP Costa Rica</li> <li>• Sr. Víctor Campos, Presidente pro tempore de GWP Centroamérica</li> <li>• Sr. Julio Calderón, Secretario Ejecutivo del Consejo Agropecuario Centroamericano (CAC)</li> <li>• Sra. Gloria Abraham, Ministra de Agricultura y Ganadería de Costa Rica (MAG) y Vicepresidenta pro tempore del Consejo Agropecuario Centroamericano (CAC)</li> </ul>	
2	8:45-9:15	Pilares de la Política Agroalimentaria de Costa Rica: La importancia de la gestión sostenible del agua	Sra. Gloria Abraham Peralta, MAG
3	9:15-10:15	<b>PRESENTACIÓN MAGISTRAL</b> Seguridad Hídrica: Esencial para hacer frente al reto de alimentar a nueve mil millones de personas	Dr. Mohamed Ait-Kadi, Presidente del Comité Técnico de GWP
4	10:15-10:45	Seguridad alimentaria y nutricional en Centroamérica y República Dominicana: Tendencias y desafíos	Sr. José Emilio Suadi H., Representante de la Organización de las Naciones Unidas para la Agricultura y la Alimentación (FAO) en Costa Rica
	10:45-11:00	Preguntas y respuestas	
	11:00-11:15	Café	
5	11:15-11:45	Políticas para la seguridad alimentaria a nivel regional y su relación con la gestión del agua	Sr. Manuel Jiménez, Especialista del CAC
6	11:45-12:15 m	Las tecnologías de la información en el uso sustentable, eficiente y rentable del agua en la agricultura	Dr. Enrique Mejía Sáenz, Presidente de la Asociación Nacional de Especialistas en Irrigación de México
	12:15-12:30	Preguntas y respuestas	
	12:30-2:00pm	Almuerzo	
7	2:00-2:30	La perspectiva del clima: Su relación con la seguridad hídrica y alimentaria	Sra. Patricia Ramírez, Secretaria Ejecutiva del Comité Regional de Recursos Hidráulicos (CRRH-SICA)
	2:30- 2:40	Preguntas y respuestas	

8	2:40-4:00	<p><b>PANEL:</b> Acciones para la seguridad alimentaria e hídrica en Centroamérica: Retos y oportunidades para el uso eficiente y sostenible del agua en la producción de alimentos con sentido de adaptación al cambio climático</p> <p><b>PANELISTAS:</b></p> <ul style="list-style-type: none"> <li>• Sr. Carlos Pomareda, Gerente SIDE S.A.</li> <li>• Sr. Bernal Soto, Gerente de Servicio Nacional de Aguas Subterráneas, Riego y Avenamiento de Costa Rica (SENARA)</li> <li>• Sr. Jorge Faustino, Investigador del Centro Agronómico Tropical de Investigación y Enseñanza (CATIE)</li> <li>• Walter Cruz, Gerente Empresa de Tilapias</li> </ul>	<p>Presidente del panel: Alfredo Volio Pérez, Ex Ministro de Agricultura y Presidente del Banco Nacional de Costa Rica</p>
9	4:00-4:20	Conclusiones sobre el nexo entre el agua y la producción de alimentos	CAC-GWP Centroamérica
	4:20-4:40	<i>Café</i>	
10	4:40-6:00	<p><b>PANEL: Como hacer efectiva la gobernabilidad del agua en Costa Rica: La visión de los diversos sectores</b></p> <p><b>PANELISTAS:</b></p> <ul style="list-style-type: none"> <li>• Sr. Alfonzo Pérez Gómez, Presidente de la Comisión de Ambiente de la Asamblea Legislativa</li> <li>• Sra. Andrea Meza, Presidenta de CEDARENA</li> <li>• Sra. Maria Guzmán, MINAE/Dirección de Aguas</li> <li>• Sra. Luisa Díaz, Asesora en Competitividad y Medio Ambiente de la Cámara de Industrias</li> <li>• Sr. Rafael Oreamuno, Universidad de Costa Rica</li> </ul>	<p>Presidenta del Panel: Sra. Maureen Ballesteros, Presidenta GWP Costa Rica</p>
	6:00	Clausura	Vice-Presidencia de la República

## Participants

NAME	ORGANIZATION
A. Jesus Cajal	Alianza por el Agua
Adrian Hernandez Rodriguez	Comisión Nacional del Agua de México (CONAGUA)
Alexa Morales	Fundación para el Desarrollo de la Cordillera Volcánica Central (FUNDECOR)
Alfonso Brenes	Servicio Nacional de Aguas Subterráneas, Riego y Avenamiento (SENARA)
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Álvaro Porras	Dirección de Agua
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Ana Lorena Leon	Asamblea Legislativa de Costa Rica
Ana Lorena Salmerón	Universidad Técnica Nacional (UTN)
Andrea Amighetti	Periodista
Andrea Rodriguez V.	Periódico El Financiero
Andrei Beurrovet V.	Instituto Costarricense de Electricidad (ICE)
Andres Mora P.	Red Centroamericana de Acción del Agua (FANCA)
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Arturo Salgado	ANEI
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## > About GWP

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The **Global Water Partnership (GWP)** is an international network of organizations involved in the management of water resources. GWP's vision is for a water secure world and mission is to support the sustainable development and management of water resources at all levels. GWP was established in 1996 to foster integrated water resources management (IWRM) which is defined as the coordinated development and management of water, land, and related resources in order to maximise economic and social welfare without compromising the sustainability of vital environmental systems.

## > About CAC

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The **Central American Agricultural Council (CAC)** is part of the Central American Integration System (SICA) and is responsible for proposing and implementing actions, programmes and regional projects in the field of agriculture, forestry and fisheries; in aspects of policies for plant and animal health as well as scientific research and technological modernization of production. The CAC must coordinate with the Council of Ministers of Foreign Trade with regards to agricultural trade in the region. CAC is composed by the Ministers of Agriculture of Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama.