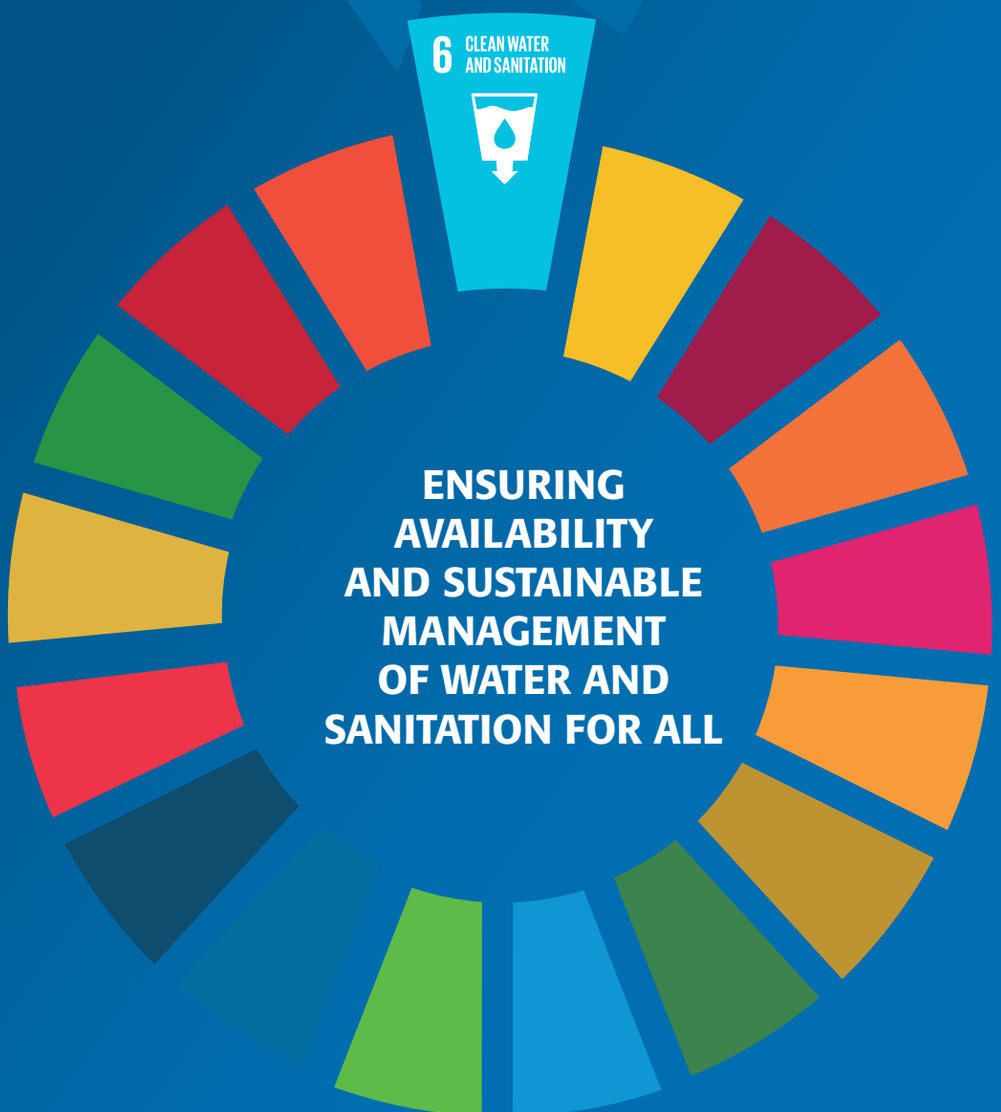
ASAZGUA
Asociación de Azucareros de Guatemala

SUSTAINABLE WATER & ENERGY SOLUTIONS NETWORK

CASE STUDY:

Activities by the Guatemala Sugar Agroindustry supporting the implementation of the Sustainable Development Goal 6 (SDG 6) of the United Nations 2030 Agenda for Sustainable Development.



Asazgua: Association of Sugar Producers of Guatemala | 2023

ENSURING AVAILABILITY AND SUSTAINABLE MANAGEMENT OF WATER AND SANITATION FOR ALL

ASAZGUA
Asociación de Azucareros de Guatemala

SUSTAINABLE
WATER &
ENERGY
SOLUTIONS
NETWORK

6 CLEAN WATER AND SANITATION

Ensuring Availability and Sustainable Management of Water and Sanitation for All / Asazgua

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Target 6.2: By 2030, achieve access to adequate and equitable sanitation and hygiene for all, and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.

Target 6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

Target 6.4: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.

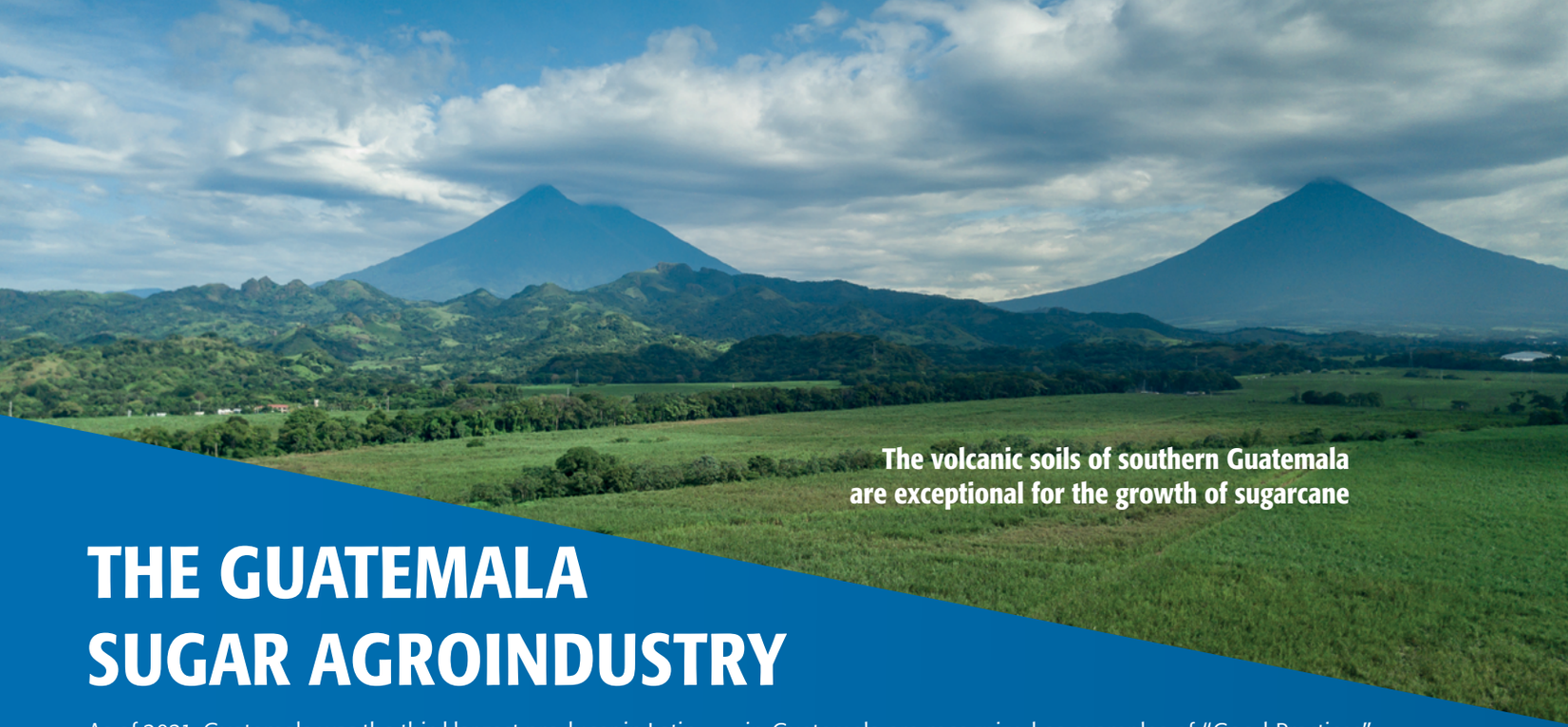
Target 6.5: By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.

Target 6.6: By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.

Target 6.a: By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programs, including water harvesting, desalination, water efficiency, waste-water treatment, recycling and reuse technologies.

Target 6.b: Support and strengthen the participation of local communities to improve water and sanitation management.

Source: United Nations, 2015.



The volcanic soils of southern Guatemala are exceptional for the growth of sugarcane

THE GUATEMALA SUGAR AGROINDUSTRY

As of 2021, Guatemala was the third largest producer in Latin America and the sixth largest exporter of sugar in the world. Sugar is the second agroindustrial product most exported of Guatemala. The Guatemala Sugar Agroindustry generates almost US $700 million in foreign exchange annually and provides more than 55,000 direct jobs and 278,000 indirect jobs in the country. Besides, the sector receives products and services from more than 6,000 small, medium-sized and large enterprises, which also generate more employment. Only 2.97% of the cultivable land in Guatemala is used for sugarcane production. Asazgua, the Association of Sugar Producers of Guatemala, was created in 1957 to coordinate the activities of the Guatemala Sugar Agroindustry. It includes 11 sugar producers and five technical organizations specialized in research, climate change, sugar exportation and social responsibility (Asazgua, 2020). In addition, since 2022, it counts with an organization specialized in innovation. The sugar producers that are members of Asazgua include: Pantaleon, Concepción, Palo Gordo, Santa Ana, Magdalena, Santa Teresa, La Unión, Madre Tierra, Trinidad (San Diego), La Sonrisa and El Pilar.

The Guatemala Sugar Agroindustry is committed to generating opportunities and prosperity for the people of Guatemala that support the country's sustainable development. It promotes decent and valuable jobs for the wellbeing of the population, while at the same time promoting environmental protection and conservation.

The Guatemala Sugar Agroindustry follows sustainable development principles as reflected by its strategic objectives and integrated actions and programs, supporting social wellbeing, economic growth, industrialization, and environmental protection. The activities of the sugar industry in Guatemala are recognized as examples of "Good Practices" in the effective implementation of the United Nations 2030 Agenda for Sustainable Development and the Sustainable Development Goals.

Associated organizations supporting specific sustainable objectives of the Guatemala Sugar Agroindustry have been created in the last decades. In 1990 Fundazúcar was launched as the social branch for the development and implementation of programs and projects on health, education and development. In 1992 Cengicaña started research activities to develop new varieties of sugarcane, to have integrated pest management, to study land quality and to implement more efficient processes for the cultivation of sugarcane and for the production of sugar. In 1994 Expogranel, one of the most efficient boarding terminals for sugar export in the world, was launched to cover international markets in a more efficient and competitive manner. In 2010, the Private Institute for Climate Change Research (ICC) was created to perform research, activities and projects related to climate change. In 2022 the Innovation Hub was created to develop a program of innovative projects through the identification and optimization of products, activities, processes and business models of the Sugar Agroindustry.

At the international level, the Guatemala Sugar Agroindustry supports the work of ICC on climate change mitigation and adaptation with other countries of Central America. Also through Asazgua, it participates actively in the Global Network on Sustainable Water and Energy Solutions. This is an initiative led by the Division for Sustainable Development Goals of the United Nations Department of Economic and Social Affairs (UNDESA). The Network promotes integrated water and energy solutions that address climate change objectives worldwide.

SUSTAINABLE DEVELOPMENT STRATEGY

The Sustainable Development Strategy of the Guatemala Sugar Agroindustry is based on its vision, mission and objectives which promote a comprehensive and forward-looking transformative pathway to prosperity and peace for the people of Guatemala, at the same time supporting a healthy and sustainable planet. It follows an integrated approach based on transformation and adaptation to changes expected in the future due to new challenges. With its inclusive participation policy with multi-stakeholder partnerships, the Sugar Agroindustry, through Asazgua, is committed to coordinating the work of enterprises, governmental entities and civil society to achieve the final goal of prosperity and sustainable development for Guatemala. The Guatemala Sugar Agroindustry is a global example of efficiency and technological advance representing a very relevant factor for the economy of Guatemala with important positive impacts also on the social and environmental dimensions of sustainable development.

Objectives

1. Increase productivity through development and improvements in the field and in sugar refineries
2. Provide technical training and capacity building for human resources
3. Develop projects and programs that increase the capacity of the production systems in the field and in sugar refineries, in distribution and commercialization of products, and of the export boarding systems.

One of the objetives of the Guatemala Sugar Agroindustry is to Increase productivity through development and improvements in the field and in sugar refineries.

Vision

Before 2025 the Guatemala Sugar Agroindustry will be the most respected productive sector of the country due to diversification, competitive efficiency, generation of dignified jobs, and respect for the environment, suppliers and communities with whom it relates.

Given its policy of unified action, proactive attitude and strong socioeconomic support, the Sugar Agroindustry leads as a positive agent of change for integral development, boosting the progress of its members and the country.

Mission

The Guatemala Sugar Agroindustry mission includes the following: to act in united manner to cultivate and process sugarcane to produce sugar, electricity, ethanol and other products; to undertake other activities to increase the value of the associated enterprises with a positive impact on the integrated development of the country; to innovate constantly improving competitive efficiency; to facilitate national and international commercialization of sugar; and to ensure sustainability while building trust responsibly.

THE GUATEMALA SUGAR AGROINDUSTRY AND THE SDG 6

Agriculture is the biggest water user in the world (UNESCO, 2009). Around 70 % of water withdrawals is used for agriculture globally. In Africa, Asia and Latin America, between 71 and 86 % is used for agriculture. In Europe and North America around 32 and 39 % is used for agriculture because the share of industrial use is bigger. In the case of Guatemala, there are no record of users nor of volumes of water used. However, it is estimated that between 10 to 25 % of existing water in Guatemala is used, and the share of agricultural use is 70 %.

There are two concepts that are used as framework for water management in the sugar agroindustry of Guatemala, namely: water security and integrated water resource management. They both focus on the role of water for livelihoods, human wellbeing, socioeconomic development, ecosystems, and disasters. Even though most of the work by the Sugar Agroindustry is related to irrigation and water use in industrial processes, there are important contributions in other aspects, such as: water access and sanitation, research and integrated watershed management.

A model of integrated and participatory water management is being implemented. The model promotes best practices for water and soil conservation, preserving terrestrial and water ecosystems. The results of these actions are monitored through ecosystem integrity and water quality evaluations of the rivers. A sustainable culture is induced through awareness and education that promote changes in the habits, values and beliefs of the communities in support of sustainable water measures.

The most important activities by the Sugar Agroindustry with respect to water relate to the specific targets of SDG6 addressing water access for communities in the area of operation, efficient use of water based on integrated management of water resources, protection and restoration of ecosystems services, improving water quality and quantity, reducing pollution and strengthening participation of local communities. These activities are part of a comprehensive program designed to ensure the environmental, social and economic sustainability of the region and the prosperity of its inhabitants. Activities more directly related to ecosystems include the conservation of watersheds, the restoration of riverside forests, the formation of biological corridors and conservation of agricultural soils.

Activities related to water and the SDG 6 are being conducted by the Private Institute for Climate Change Research (ICC), Cengicaña and Fundazúcar under the umbrella of Asazgua.

1. WATER SUPPLY AND WASTEWATER

1.1. Water Supply And Wastewater

Objectives and Description

Guatemala faces considerable challenges in terms of water resources management. In the latest evaluation of implementation of integrated water resource management, Guatemala scored 20 out of a 100 (GWP, 2021). The Sugar Agroindustry of Guatemala recognizes the importance of integrated water resource management, within` its production processes and its promotion in the country. Therefore, the industry has made considerable progress increasing efficiency in irrigation and industrial water use. Also, it has made contributions in water research and capacity building. Roundtable multi-stakeholder consultations have been organized with local governments to facilitate dialogue on water needs and water use among local communities, agro-export companies, governmental organizations and municipalities.

Fundazúcar has an Engineering and Water Sanitation Unit (UNISAN). Created in 2001, UNISAN promotes the execution of infrastructure projects that allow Municipalities access to safe water by providing free expert technical advice.

The Sugar Agroindustry, through Fundazúcar, provides free assistance and technical advice for the preparation of projects, which are necessary for the allocation of funds for construction, contributing to the welfare and development of the communities. These activities support the government authorities who are responsible for the financing and execution of water and sanitation infrastructure works. These projects benefit close to half a million people in rural areas. Community management has allowed the construction of 129 projects. Currently 12 new projects are being built and 45 already have approved funds. Over 290 infrastructure studies have been conducted for different communities.

Another critical area, in which information is collected, is in relation to the levels of community water wells. Groundwater is a strategic resource in the Pacific Lowlands region of Guatemala. Around 40% of the population in this region lacks running water at home and relies on wells to access groundwater. The ICC monitors 249 wells four times a year to follow changes in the water levels and to anticipate any problems that might occur in the region.

In the Community Development Plans, projects are defined and prioritized by local representatives who are also involved in defining the timeframe to carry them out.

UNISAN STUDIES 2001-22

This unit, created in 2001, promotes the execution of water and sanitation infrastructure projects at the municipal level, providing professional technical assistance.

+US$ 40 million in funds movilized

Population coverage 541,039

290 projects designed

12 on execution

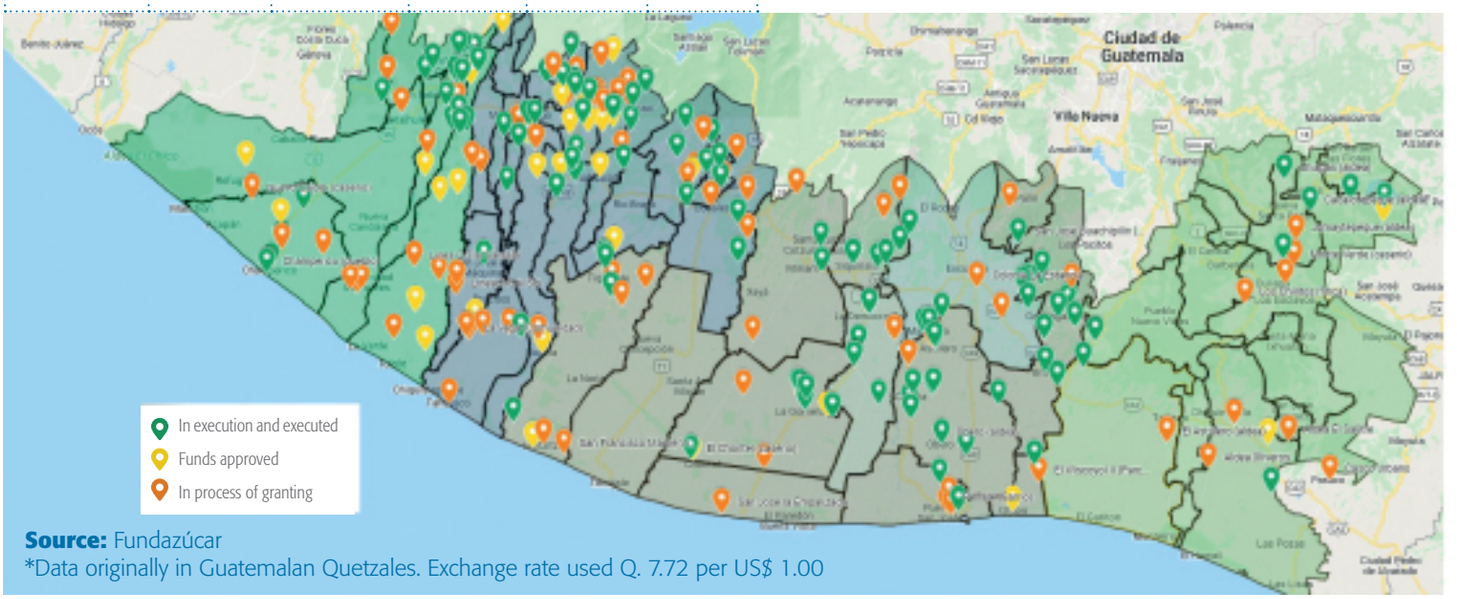
129 executed

45 with funds approved

Funds movilized

Status

Department	Without Municipal follow up	In process of granting	Funds approved	In execution	Executed	Total	Fundazúcar's contribution	Cost of investment	Beneficiaries	Movilized funds
Santa Rosa	0	9	3	1	5	18	$564,446.98	$7,055,587.22	31,421	$3,007,791.33
Escuintla	5	35	8	3	62	108	$2,267,494.09	$28,343,676.29	291,589	$15,294,319.58
Suchitepéquez	5	39	18	2	41	105	$1,667,506.10	$20,843,832.70	133,855	$13,701,764.90
Retalhuleu	1	14	16	6	21	58	$1,009,748.81	$13,746,860.12	81,834	$8,175,717.70
Jutiapa	0	1	0	0	0	1	$86,136.99	$1,076,712.37	2,340	$0.00
Total	**11**	**98**	**45**	**12**	**129**	**290**	**$5,595,332.97**	**$71,066,668.70**	**541,039**	**$40,179,593.50**
Percentage	3.87	30.63	15.85	4.23	45.42					



Source: Fundazúcar

*Data originally in Guatemalan Quetzales. Exchange rate used Q. 7.72 per US$ 1.00

Related Targets

These activities support the objectives of Target 6.1 of achieving universal and equitable access to safe and affordable drinking water for all and of Target 6.2 on achieving access to adequate and equitable sanitation and hygiene for all.

Challenges

Water access in Guatemala is still a major challenge in many communities. The work of the Sugar Agroindustry in this field is very valuable but needs to be coordinated with official authorities and the impact in the long run depends on additional efforts by the government. Other challenges include reliability of water services, water quality, service quality, water disputes and the increase in population in the affected areas that imply the corresponding increase in water access.

According to the Global Water Partnership (Central America), the main challenges in water and sanitation are: increasing the percentage of households with access to water, improving the continuity of the service as well as improving water quality (GWP, 2015). The 2018 census showed that sanitation coverage is lagging much more than water service (INE, 2018).

Another major challenge is the lack of political will and capacity from the local authorities to access funding that is available for water and sanitation.

Lessons Learned

This experience by the Sugar Agroindustry has demonstrated that in addition to providing support for water access and treatment, other important relevant activities need to be completed or other additional services need to be provided. In particular, the need to provide sanitation services in isolated communities and the need to perform hydrogeological studies in some areas.

Results

The Sugar Agroindustry, through Fundazúcar has been able to ensure water access to a considerable number of communities in the south coast region of Guatemala. Monitoring support of water quality and quantity is also provided through ICC. These activities support the government authorities who are responsible for the financing and execution of water and sanitation infrastructure works. These projects benefit more than half a million people in rural areas. Community management has allowed the construction of 129 projects. In 2022, 12 new projects are being built and 45 already have approved funds. Over 290 infrastructure studies have been conducted for different communities.

Design process of the sanitary sewer system from Multicultural Community "Nueva Olga María Cuchuapan", Champerico, Retalhuleu, Pacific Lowlands of Guatemala.

2. WATER USE IN AGRICULTURAL AND INDUSTRIAL PROCESSES

Photographer: Manuel Villeda
Ingenio Madre Tierra

2.1. Water use in agricultural and industrial processes

Objectives and Description

The Guatemala Sugar Agroindustry operates within the framework of its own environmental management policy of guild compliance that has allowed the standardization of practices in the management and use of water, air quality, use and application of agrochemicals, solid waste management and conservation of biodiversity.

Water is essential for living and for agricultural and industrial processes. Due to climate change impact, and natural phenomena (such as El Niño), the sugar industry has come to implement better management practices to reduce water consumption and make a rational use of the resource.

The Sugar Agroindustry participates in roundtables with community, local authorities, institutions and governmental and human rights organizations, as well as other companies and sectors, to coordinate the rational use of water from the rivers.

Water use in agricultural processes has been reduced by implementing more efficient irrigation systems and by the application of new technologies and processes. Investment by the Sugar Agroindustry in irrigation systems has allowed the development of practices for the rational use of water in agriculture. More specific information is provided below in the "Irrigation Management" section.

In the industrial process, used water is sent to cooling systems (towers or sinks) to be reused later in the process. Industrial wastewater from the sugar production is also reutilized after being treated for fertigation which allows a timely supply of water and fertilizer application. Sludge treatment systems are connected to irrigation systems to allow the conditioning of soils with essential nutrients for the growing of crops. One of the measures adopted by some of the sugar producers was to eliminate the use of water to clean the sugarcane before the milling process. The sugarcane is cleaned by vibration devices to eliminate the solids transported by the sugarcane. This practice has represented the most significant water saving strategy for those using it.

The Sugar Agroindustry performs wastewater monitoring in all the sugar mills to ensure the fulfillment of standards established by the environmental regulation in force since 2006[1].

In 2018 studies were initiated on the water footprint of sugar and sugarcane. This refers to the quantity of water used in production, including rainwater (green water footprint), both ground and surface water (blue water footprint), as well as wastewater (grey water footprint).

For Harvest 2020-2021, the average water footprint of sugarcane cultivation in Guatemala is estimated at 115.10 m3 of water per ton of sugarcane, which is 45% below the world average. Some 75.54 % of the water used for the sugarcane crop in Guatemala is provided by rainfall and 18.85% by irrigation from surface and underground sources (ICC, 2021).

[1] ACUERDO GUBERNATIVO 236-2006: Use and management of wastewater and sludge treatment, issued by the Ministry of Environment.

Related Targets

The activities related to water use are directly related to Target 6.4 which calls for substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater and reduce the number of people suffering from water scarcity. These activities also support Target 6.3 on improving water quality by reducing pollution and reducing the proportion of untreated wastewater and increasing recycling and safe reuse of water.

Challenges

One of the main challenges is continuing moving towards more efficient irrigation systems. The knowledge dissemination and the creation of awareness for the responsible and efficient use of water is a task that needs constant attention. Other major challenges include the need to modify water efficiency practices to adapt to the new impacts from climate change and performing additional research to learn more about the behavior of groundwater.

Lessons learned

It is clear that investment in research and development of innovative technologies and software is necessary to ensure sustainability of water resources.

Results

The Sugar Agroindustry has been able to effectively reduce the use of water through the implementation of efficient water use techniques. It has improved agricultural practices and has made major investments in efficient irrigation systems. Major water savings have continued to increase through the years both in the field and in industrial processes. In the field (crop management), progress has been made in the implementation of more efficient irrigation systems, the development of sugarcane varieties that are more resistant to droughts and the participation in water governance models. In industrial processes, good results have been obtained from water reuse, recirculation and recovery from industrial plants. Today the Guatemala Sugar Agroindustry has a water footprint of sugarcane cultivation which is considerably lower than the rest of the world average.

3. IRRIGATION MANAGEMENT

3.1. Irrigation Management

Objective and Description

Sugarcane cultivation in Guatemala covers around 320,000 hectares (MAGA, 2021), of which about 85 to 88% are irrigated. Sugarcane plantations and sugar mills have been taking many measures over the past 20 years to increase the efficiency of irrigation. This includes research, investment, and installation of efficient irrigation technology. There have also been many efforts to reduce the water footprint in the sugarcane mills through improvement of efficiency, water re-use, and the elimination of washing of sugarcane.

The application of good practices in irrigation has the objective of securing the sustainability of water resources. In order to achieve this objective, it is necessary to have integrated knowledge related to the water use in sugarcane production under different soil conditions, altitudes and under the incidence of different natural phenomena and throughout the whole crop cycle up to the harvest. This knowledge allows the selection and implementation of the best strategies for water use during the irrigation process.

The use of water in agricultural processes for the production of sugarcane has been reduced through the implementation of more efficient irrigation systems and new technologies. Water used in fields for irrigation has been reduced by 16% in 2020 as compared to 2015. Cengicaña published in 2017 a Guide to Good Agricultural Practices for sugarcane that includes a chapter on irrigation management. The Guide has allowed the dissemination of knowledge and the training of the corresponding personnel of the Sugar Agroindustry (Cengicaña, 2017).

The use of the different irrigation systems depends on factors such as: investment costs, water use efficiency, operational costs and management easiness. During the 1990's the predominant irrigation systems were by gravity, by flooding and canyon spraying; then by 1998, new technologies came to hand. Different approaches to irrigate among furrow (all or every other furrow); uses of water pumping systems, gravity conduction or canyon spray were employed. The

Agroindustry Irrigation Committee analyzed and validated in 2005 the following classification for the sugarcane plantation area: irrigation systems by groove, pressurized irrigation systems (stationary sprinkler systems and sprinkler systems with continuous displacement) and giant sprinklers (travelling gun and drip irrigation systems) (Castro, 2012).

CENGIRIEGOS Software

CENGIRIEGOS is a software tool designed for irrigation and agrometeorology. Its implementation in the areas of the Guatemala Sugar Agroindustry supports the optimization of the water use in sugarcane production and in the technical decision-making process related to climate changes. This tool allows the efficient use of water and energy and corresponding savings based on the interrelationship that exists among water, soil, sugarcane and climate. The software is able to recommend the volume of water to be applied to a specific plot. The CENGIRIEGOS v.3 platform is based on information and data of the daily hydrological balance. It permits the integration of technological options that allow the automatization of information for the modeling and adjustment of the hydrological balance measuring humidity with previously calibrated sensors.

During the 2019-2020 harvesting, the personnel of the sugarcane producers were trained in the use of this software tool. The decisions related to the optimum time for irrigation of a total of 30,040 hectares were made using this tool during the dry season of Harvest 2020-2021.

Related Targets

The activities related to water use are directly related to Target 6.4 which calls for substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply.

Challenges

There are many factors that affect irrigation and that need to be considered. Some of these factors vary from year to year making it difficult to be able to determine the best irrigation strategy. The use of innovative technologies and software is a dynamic task that requires attention and investment. Legislation, planning and governance around water resources in Guatemala are weak (GWP, 2021). As a result, the lack

of legal certainty is a major challenge over the use of water resources for irrigation. Another related challenge is the increase in local conflicts between users, including farmers and communities. Considering the growth in water demand, higher climate variability and decreasing levels of rainfall, access to water in the future is uncertain.

Lessons learned

An important lesson learned is that the application of good practices in irrigation are beneficial in the long term to secure the sustainable use of water and land resources. The investment on technologies and software and on building capacities ultimately translate into economic benefits as well as social and environmental advantages. In the absence of legislation and institutions, dialogue between water users is key for everyone's benefit and to reduce conflict.

Results

The Sugar Agroindustry has been effective in its goal of reducing water use in irrigation processes through innovative technologies, systems and processes. Efficient irrigation is allowing the industry to receive considerable economic benefits while securing the sustainability of water resources.

4. WATER RESOURCE RESEARCH

Sensors used to measure meteorologial conditions. From left to right: thermohygrometer, pyranometer, pluviometer, humidometer.

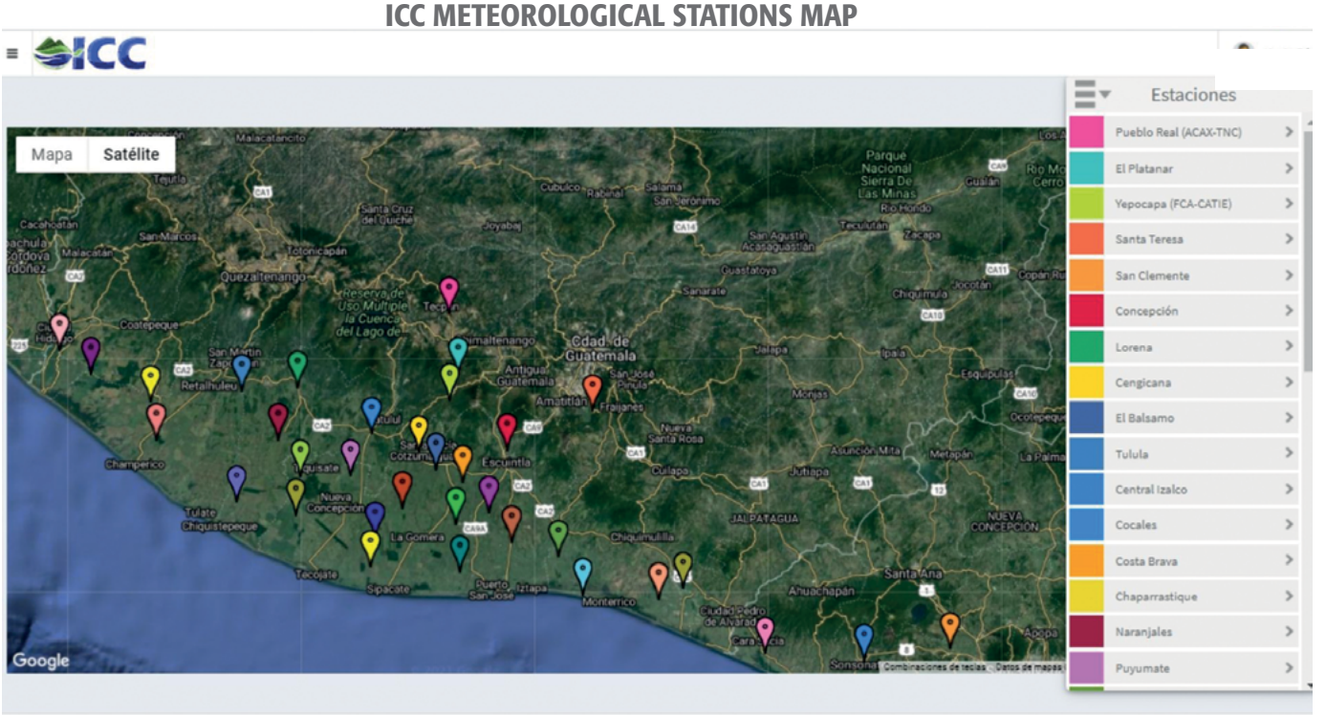
4.1. Water Resource Research

Objective and Description

Water is a vital resource for the production of sugar and for the generation of electricity from its biomass. Information and research on water resources is a key element for water management, particularly under an integrated approach. Therefore, the Guatemala Sugar Agroindustry has invested in the generation of data and research through two major initiatives and activities. The first one, through the creation of Cengicaña (The Guatemalan Sugarcane Research and Training Center) in the early 1990s. The main focus was research on irrigation systems. The agroindustry started investing in an automated weather station network in 1997 in order to have data for the management of the crop and given that government coverage of public stations was rather poor. By 2010, 16 stations were under operation in the sugarcane growing areas, all managed by Cengicaña. Some data on river flows started being generated in 2005 also by Cengicaña, covering only the main rivers.

The second major initiative was investing through the foundation and funding of the Climate Change Research Institute (ICC) in 2010. One of the five main programs of work was set to generate data and to carry out research on climate and hydrology. The weather station network started being managed by the ICC in 2011 and it was improved (changing to GPRS signal transmission) and expanded reaching 33 stations by the end of 2021.

ICC METEOROLOGICAL STATIONS MAP

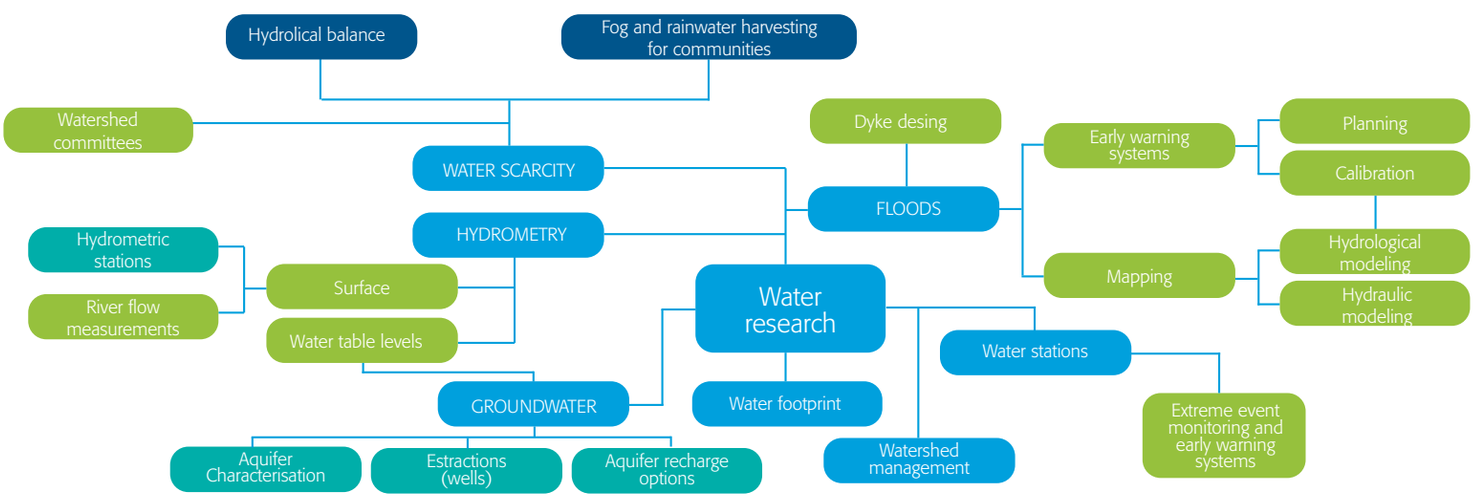


Source: ICC Website. https://icc.org.gt/es/red-de-estaciones-meteorologicas-icc/

Data are generated about the river flows in the dry season. This information is used to guide technical roundtables and committees regarding the use of water in a rational manner. 58 rivers are monitored, creating more than 6,000 data points each year. The information generated has contributed to fulfilling the main objective of the local technical roundtables which is to ensure that water, which is a common good, arrives at the mouth of the river on a permanent basis. Additionally, water table levels have been monitored since 2015 in community wells in order to study the dynamics of groundwater and, mainly, to ensure water extraction for irrigation does not have an impact on communities.

Research on water resources covers several topics, as Figure 1 shows. Analysis is carried out to reduce risk associated with flooding and droughts, which are recurrent in southern Guatemala. The water footprint of sugarcane cultivation has been estimated since 2017. Groundwater research is an area of growing importance because it is a key resource and there is virtually no previous knowledge for it in southern Guatemala, making its management and efforts to recharge it particularly challenging. Finally, monitoring extreme events, phenomena such as El Niño/La Niña, and studying how they relate to sugarcane are part of the ICC's contributions to the agroindustry. Cengicaña has continued to be in charge of research related to irrigation.

Figure 1: Water and Research actions carried out by ICC through funding by the private sector



Related Targets

The climate and hydrology research with its comprehensive approach to data collection and analysis in relevant meteorological, climatological, and hydrological areas is contributing to the objectives of Target 6.5 on implementation of integrated water resource management by generating meteorological data and information. It also supports the objectives of Target 6.6 by analyzing critical and valuable data and information and by providing recommendations for actions and technical and scientific strategies key to water resources.

Challenges

One of the main challenges related to this activity is the collection of data in very remote areas. There is also the need to expand the data collection coverage in the country and also to increase the frequency of data collection and the number of parameters being monitored. Another challenge is the purchase of equipment and the constant maintenance and follow up, which is what the national system usually lacks. ICC has done it successfully, but the expansion is a challenge. Also, communication of data and information to stakeholders and decision makers is always a challenge. Resources are scarce to carry out research on topics that require technology and knowledge.

Lessons learned

The Guatemala Sugar Agroindustry understands the importance of working in partnership with governmental organizations, local stakeholders, academia, and other stakeholders to ensure the success of all these important activities.

Collaboration with national and foreign universities is important. The main way to collaborate has been through interns or students doing their thesis at the ICC. Interns help through their time and intellectual contributions and also through supervision and resources from their respective universities.

It is important to combine scientific and technical information with knowledge from local people. This has been particularly important in the mapping of flood-prone areas.

Results

There are very positive results obtained in the last 11 years allowing and expanding database and analysis of critical meteorological and hydrological parameters. The research work has provided an important contribution in the effective management of water supplies and groundwater availability. Additionally, there is a much better understanding of climate variability and the occurrence of storms and other weather events.

5. INTEGRATED WATERSHED MANAGEMENT

5.1. Integrated Watershed Management

The Guatemala Sugar Agroindustry recognizes the importance of integrated watershed management to regulate the water cycle and mitigate the impacts of flooding and droughts. The Guatemala Sugar Agroindustry commissioned ICC to conduct an Integrated Watershed Management program. The program includes planning and execution of socio-environmental actions carried out at the watershed level with a strong participatory component of local stakeholders.

Objective and Description

The main objective of the Integrated Watershed Management program is to promote and implement actions that maintain the integrity of the natural resources in the relevant watersheds considering the socio-cultural context. To achieve this objective, the following main work areas have been established:

- Generation of primary data on the watersheds and to establish a baseline
- Promotion and follow up on social organization processes to manage watersheds
- Forest protection and restoration
- Integrated water resource management
- Soil protection

Assistance is provided for the conservation and restoration of mangroves and forests along watersheds. Since the creation of ICC in 2010, the Sugar Agroindustry has provided financing for forest conservation and for reforestation of areas in all the watersheds of the sugarcane zone. By 2020, support had been provided for the protection of 5,800 hectares of forests in coordination with communities and municipalities located in the high parts of the watersheds. About 81 hectares of mangroves had been restored and about 6,000 hectares had been reforested in private, community and municipal lands in all the watersheds. Up to 2021, about 6.8 million trees were produced for this purpose in 484 nurseries financed by the Guatemala Sugar Agroindustry.

Activities have been conducted to support the conservation and protection of the natural resources of the sub watershed of the Ixtacapa and Mazá rivers covering over 950 hectares.

Mangrove restoration activities have also been conducted in the communities of Blanca Cecilia, Iztapa and Escuintla as well as in the Suchitepéquez Department. These mangrove restoration activities were evaluated in 2018 (ICC, 2019b).

Activities of forest restoration had been expanded with resources from other sectors, such as the Independent Banana Producers Association (APIB), the Central America Bottling Corporation (CBC), Palo Blanco (banana and avocado exporters), and the United Nations Development Program (UNDP).

Following high levels of conflict over the use of water in 2016, roundtables were created for several rivers as dialogue mechanisms that included local authorities, governmental organizations, communities, NGOs, and the private sector (including the sugarcane growers and companies). Agreements were reached and fulfilled leading to low levels of conflict. One of the agreements was to put in place a monitoring system spanning all watersheds in the Pacific region. Those technical roundtables have been highly successful in coordinating water use with multiple stakeholders and keeping rivers running. A synthesis of results by the monitoring system attests to one aspect of the success (ICC, 2021). The case of two rivers was documented (through funding by the European Union) in its initial stages because it can serve as an example of water conflict management (Gobernación de Escuintla, ACH & ICC, 2017). Since it contributed to coping with water scarcity triggered by a very intense El Niño event and then helped take actions in situations of flooding, the technical roundtables were included as a case study of water governance that can help adapt to climate extremes in the latest IPCC assessment report (IPCC WGII, in press).

Related Targets

Activities on Integrated Watershed Management are directly linked and are fully supportive of the objectives of Target 6.5 on implementing Integrated Water Resource Management at all levels. It also supports the objectives of Target 6.6 on protecting and restoring water-related ecosystems including mountains, forests, wetlands, rivers, aquifers, and lakes.

Challenges

A major challenge is to ensure the participation and commitment of all the users and actors of the watersheds in coordination with the State entities in charge of the environmental regulations. Raising awareness of the long-term benefits of an ecosystem service approach that includes climate change strategies and the integrated management of water and terrestrial ecosystems is another important challenge.

In Guatemala, except for the main lakes, there are no authorities for the watersheds. All the work supported by the Guatemala Sugar Agroindustry and promoted by the ICC can contribute to watershed management, but its impact is limited because of the lack of official institutions and plans. A consequence is less participation from most of the relevant stakeholders in each watershed.

Another challenge is that there is no official watershed governance, plans and regulations. All the work done depends on the goodwill of stakeholders. Relevant legislation has been in place since 2021, and its implementation is just starting.

Lessons learned

The integrated management of watersheds depends on alliances and partnerships between private and governmental organizations as well as local communities. Therefore, major efforts are necessary to ensure the active and constant participation and support of relevant stakeholders for the success of integrated watershed management programs.

Even without a legal mandate and institutions for watershed management, local stakeholders can start planning and implementing actions toward the protection of natural resources, namely, water, soil, and forests in their corresponding watersheds.

The private sector can be an active stakeholder, implementing actions within their production system, and supporting actions outside them working in collaboration with other stakeholders.

Results

The program has implemented successful projects in important watersheds of the region. The success of these activities and the benefits obtained support the planning and implementation of future projects that will translate into further sustainable local development. In addition to the environmental benefits, the program has enhanced social and economic inclusion in the region and is promoting a cultural change in the relationship among people, relevant organizations and nature in the participating communities.

6. INTEGRATED WATER RESOURCE MANAGEMENT

Photographer: Oscar Rodolfo Morales Méndez, ICC

6.1. Integrated water resource management

Objective and Description

Integrated water resource management is a very valuable approach for the sustainability of water resources and to support adaptation and vulnerability reduction to climate change impacts.

Some of the more important activities by the Sugar Agroindustry include:

- Support to communities and municipalities in the management of water and health including potable water systems (design and construction) through Fundazúcar.
- Efficiency, recovery, reuse and recirculation (cooling towers) of water including advances in efficiency and reuse of industrial water, and advances in wastewater management.

- Integrated watershed management including forests in the high areas, riparian forests, biological corridors and reforestation.
- Active participation in the technical roundtables of the watersheds with multiple stakeholders to ensure that river waters reach the river mouth.
- Water management including estimation of the water footprint in sugarcane crops.

(Source: ICC, 2020)

Related Targets

Activities on Integrated Water Resource Management are directly linked and are fully supportive of the objectives of Target 6.5 on implementing Integrated Water Resource Management at all levels. It also supports the objectives of Target 6.6 on protecting and restoring water-related ecosystems including mountains, forests, wetlands, rivers, aquifers, and lakes.

Challenges

Obtaining funding for the implementation of projects in integrated water resource management represents an important challenge, especially considering the need to scale up. The ICC, in coordination with the sugar mills and other stakeholders of the zone, has been critical to the implementation of these projects and for the pursuit of funding from national and international organizations.

Lessons learned

For information to be relevant not only does it need to be readily available, but scientists need to be close to the stakeholders and decision makers explaining the data and the different strategies available for the optimum use of the natural resources.
Results

The work supported by the Guatemala Sugar Agroindustry related to the integrated management of water resources has been key to ensure the sustainability of water resources in Guatemala. The activities conducted in the last decades have allowed to support the wellbeing of the population, to maintain and restore water and terrestrial ecosystems and to enhance the resilience of the country with respect of climate change impacts.

INTERLINKAGES WITH OTHER SDGs

The interlinkages between water related activities (SDG 6) of the Guatemala Sugar Agroindustry and other SDGs are considerable. The strongest interlinkages are in relation to climate change (SDG 13), terrestrial ecosystems/forests (SDG 15) and food security and sustainable agriculture (SDG12). There is also a strong interlinkage related to energy (SDG 7), given the fact that the Sugar Agroindustry is generating renewable energy in the form of electricity and ethanol which strongly depend on water uses and management. Another strong interlinkage is with respect to partnerships (SDG17), given that the Guatemala Sugar Agroindustry, Asazgua, ICC, Fundazúcar and Cengicaña have many partnerships with national, local and regional organizations committed to the protecting water and terrestrial ecosystems and to the pursuit of sustainable development in Guatemala and Central America.

CONCLUSIONS

The Guatemala Sugar Agroindustry has important integrated water resource management practices in its sustainable development approach strongly supporting the objectives of SDG 6 on water that translate into important benefits for the people of Guatemala and helping to protect aquatic and terrestrial ecosystems. These activities include: expanding water access, implementing programs and projects on water security, water use (efficiency, recovery, reuse, and recirculation), irrigation management, climate and hydrology research, and integrated watershed management.

By implementing effective actions and monitoring the results of these efforts, the Sugar Agroindustry has been able to ensure major improvements in water access for vulnerable communities in the operation areas of the Fundazúcar Engineering and Water Sanitation Unit (UNISAN) and responsible water use especially for sugarcane production and processes as well as for electricity generation. The effort represents a critical part of the integrated approach followed by the Sugar Agroindustry in its social, environmental and economic strategy that promotes prosperity and sustainable development.

The active participation of all stakeholders is essential to the successful implementation of projects related to integrated water resource management. Dissemination of information and awareness raising is essential to understand the importance of protecting water and terrestrial ecosystems and avoiding the loss of biodiversity. Communication and coordination play a key role in the best use of existing resources. The private sector can make contributions in all stages of the management process, from the science through planning and implementation. (SGCCC, 2019).

Much has been achieved in the last decades in relation to integrated water resource management and in implementing adaptation programs to climate change impacts. The work of ICC with support from the Guatemala Sugar Agroindustry and its members has been key to the advances on the protection of natural ecosystems, the avoidance of biodiversity losses and the development of emergency preparedness and contingency plans addressing potential disaster risks due to climate change. The work supported by the Guatemala Sugar Agroindustry has enhanced the resilience of the country with respect to climate change impacts, particularly in the south of Guatemala.

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