

Triangular cooperation for soil and water management for the sustainability of the agrifood systems of Caribbean countries

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**TRIANGULAR COOPERATION
FOR SOIL AND WATER MANAGEMENT
FOR THE SUSTAINABILITY
OF THE AGRIFOOD SYSTEMS
OF CARIBBEAN COUNTRIES**

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PARTNERS



CARIBBEAN PARTNERS



ANTIGUA AND BARBUDA

Ministry of Foreign Affairs, Agriculture, Trade and Barbuda Affairs

<https://agriculture.gov.ag>

The Ministry has responsibility for policy, legislation, general oversight to and administrative governance of the operations within and related to the agriculture sector and its allied agencies and institutions as well as Barbuda Affairs.

The work of the Ministry is executed through an institutional network of interrelated entities consisting of the Department of Agriculture, Allied Divisions, the Barbuda Council, Corporations and Organizations, Special projects and International and Regional Development Partners.

Program monitoring, coordination, review, and updates are achieved through regular meetings of Heads of the various pillars of the Ministry and periodic progress reports.

A multi-dimensional approach has been adopted in the implementation of the work program of the MAFBA and as such significant linkages have been established with Tourism, Trade, Health, Finance, Social Transformation, Foreign Affairs, faith-based organizations, youth groups women's groups, the military and other stakeholder organizations such as the prison and the army.

The Ministry's program is supported by its development partners through the provision of technical, financial, and human resources to facilitate capacity building as well as infrastructure and institutional strengthening.



BARBADOS

Ministry of Agriculture, Food and Nutritional Security

<https://agriculture.gov.bb/>

The Government of Barbados considers agriculture to be one of the nation's potential growth drivers and supports it through a combination of incentives and concessions to agricultural producers, high border protection, and support to research and infrastructure (IDB, 2019).

The goal of the Ministry of Agriculture and Food Security is to transform and re-position the Agricultural Sector in Barbados through the promotion of an Agri-business approach to farming, with particular attention being paid to the effective use of resources, as well as the adoption of appropriate technology and sound management practices in order to achieve internationally competitive production, processing and marketing enterprises, which contribute significantly to social and economic development and food security, as well as to the sustainable management of the natural resource base of the country.

The Ministry of Agriculture and Food Security has the task of facilitate agricultural development through the sustainable utilization of natural resources by promoting the application of good agricultural practices; promoting food and nutrition security; adopting climate smart agricultural practices and facilitating climate change research; promoting agricultural health and food safety; facilitating agri-business industries through the provision of farmer and agricultural support services and policies; fostering knowledge creation and sharing; establishing partnerships and collaboration with local, regional, and international institutions and facilitating farmer focused, solution driven research.



DOMINICA

Ministry of Agriculture, Fisheries, Blue and Green Economy

<https://agriculture.gov.dm/>

The mission of the Ministry to protect and sustainably leverage Dominica's marine and terrestrial assets, and cultural heritage in a dynamic, social and gender inclusive manner; aimed at enhancing food and nutrition security, contributing to economic growth, and improving livelihoods; achieved through a robust policy, legislative framework, enforcement mechanisms and infrastructure and with access to human, financial and technological resources.

In this sense, the specific goals are: to establish Dominica as the Global Centre for Agricultural Resilience; to increase the contribution of agriculture to the GDP/ economic growth; to create the enabling environment for national food security; sustainable use of natural resources in the sector (i.e. marine, terrestrial and energy); enhance livelihoods in the sector; poverty reduction; enhance food production and promotion of growth in the green and blue economy and increase contribution to GDP.



GRENADA

Ministry of Agriculture, Lands, Forestry, Fisheries and Cooperatives

<https://www.facebook.com/MOAGrenada/>

<https://twitter.com/moagrenada?lang=es>

The Ministry of Agriculture, Lands, Forestry, Fisheries and Cooperatives (MOALFC) has the mandate to contribute to the economic growth and sustainable development of Grenada.

This mandate places agriculture as one of the pillars of Grenada's economy as the country focuses on achieving a significant level of food security and economic growth from this sector. While Grenada has recovered well from two hurricanes in 2004 and 2005, in various sectors, the agricultural sector was an exception. Nevertheless, the Ministry is committed to the revitalization of the sector to restore its contribution to the socio-economic development of the country.

The renewed emphasis on agriculture focuses on a replanting program for nutmegs, much of which was destroyed following Hurricanes Ivan (2004) and Emily (2005), rehabilitation of the cocoa industry and supporting value additions, expanding livestock development (especially small ruminants) and expanding fruit orchards. Efforts are being made to get as much idle lands as possible under cultivation.



SAINT KITTS AND NEVIS

Ministry of Agriculture, Fisheries and Marine Resources, Cooperatives, Entrepreneurship and Creative Economy

<https://www.facebook.com/moafmrstkitts/>

The Ministry of Agriculture is made up of the following departments: Agriculture, Fisheries and Secretariat, and Cooperatives.

The Department of Agriculture provides the technical support that is needed to ensure that the citizens are food and nutritionally secured through various initiatives and programs. The main projects on going are related to Agricultural Resource Management for the erection of shade/greenhouses and the construction of water harvesting dams. These technologies are expected to increase food production through the control of pests and diseases. Also stands out the projects: "Promotion of Breadfruit and Breadnut Development in St. Kitts-Nevis"; and "Technical Assistance to promote Agricultural Diversification towards the reduction of the Food Import Bill of selected crops – Onions and Cole Crops (cabbage, broccoli, and cauliflower)" executed through collaboration with the Food and Agriculture Organization of the United Nations.

Also, the Ministry has embarked on a Vegetable, Fruit and Upland Crop Quality and Safety Improvement Project which comprises four components. These are Pesticide Management, Soil Sampling, Composting and Rapid Bioassay Testing for Pesticides Residues.



SAINT LUCIA

Ministry of Agriculture, Fisheries, Food Security and Rural Development

<https://moaslu.govt.lc/>

The development of the Agricultural sector ensures increased production of quality food and other commodities through environmentally sustainable management practices for the benefit of the entire population.

The mission of the Ministry of Agriculture is to sustain a diversified national income database from Agriculture and Fisheries and enhance the integrity of rural livelihood systems: by generating the capacity for efficiency and the competitive production and marketing of respective goods and services.

The vision of the Ministry is a vibrant, service-oriented, stakeholder focused, environmentally responsible organization facilitating integrated services aligned to a dynamic food and agricultural system.

The Agricultural Engineering Services Division (AESD), one of several divisions of the Ministry of Agriculture, mandate is to provide technical support and advisory services to farmers, agencies, and other relevant stakeholders in the areas of agricultural land management (appropriate land use soil conservation and drainage), agricultural water management (irrigation, hydroponic and aquaponics interventions) and to facilitate the improvement of the efficiency of agricultural operations through the provision of tillage support services (recommendation of tools and equipment) to enhance efficiency and reduce the cost of agricultural operations. The general objective of AESD, is to guide the optimization of agricultural land and water resources, to sustainably facilitate the increase in agricultural productivity, and reduce social, environmental, and economic cost of production in farming systems. This includes identifying limitations to agricultural productivity, recommending and/or designing sustainable interventions to remove or reduce these limitations, supervising implementation of these interventions, and therefore cause the increase in the efficiency, sustainability, productivity, and profitability of agricultural production systems.

Saint Lucia under the leadership of the Department of Sustainable Development and with support from the International Sustainable Development has prepared a National Adaption Plan. Agriculture is one of the priority sectors along with water and fisheries. A sectoral adaptation strategy and action plan have been prepared for the Agricultural Sector with EASD being integrally involved in the process.



SAINT VINCENT AND THE GRENADINES

Ministry of Agriculture, Forestry, Fisheries, Rural Transformation, Industry and Labour

<http://www.agriculture.gov.vc/agriculture/>

The Ministry is the institutional body of the state responsible for the formulation, articulation and implementation of all policies and plans relating to Agriculture, Forestry, Fisheries, Rural Transformation, Industry & Labour.

The mission of the Ministry is to ensure food security, rural development and contribute to increased employment real incomes, and foreign exchanges through programs that will promote the enabling environment for the entrepreneurial drive of farmers, fisher folks, forest users and other stake holders while ensuring the efficient utilization and sustainability of natural resources.

The Ministry of Agriculture, Forestry, Fisheries and Rural Transformation developed a twelve (12) year strategic plan for rural development, which seeks to complement ongoing initiatives for broad based economic growth. The objective of the Rural Transformation Program is to facilitate social and economic development through targeted projects designed to strengthen the human and social capital of rural communities.

The priorities outlined in this program are to promote the creation of livelihood opportunities for rural residents by facilitating training in entrepreneurship, areas of technical vocation, and other appropriate programs geared towards employment creation; to strengthen rural community groups through structured capacity building programs and to source funding and technical assistance for projects and programs aimed at rural development, zero hunger and poverty reduction.



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 Zusammenarbeit (GIZ) GmbH



GERMAN COOPERATION

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

As a service provider in the field of international cooperation for sustainable development and international education work, we are dedicated to shaping a future worth living around the world. We have over 50 years of experience in a wide variety of areas, including economic development and employment promotion, energy and the environment, and peace and security. The diverse expertise of our federal enterprise is in demand around the globe – from the German Government, European Union institutions, the United Nations, the private sector, and governments of other countries. We work with businesses, civil society actors and research institutions, fostering successful interaction between development policy and other policy fields and areas of activity. The guiding principle is sustainability. Our main commissioning party is the German Federal Ministry for Economic Cooperation and Development (BMZ).

As a public-benefit federal enterprise in international cooperation with a focus on sustainability, we represent German and European values. Together with our partners in national governments worldwide and cooperation partners from the worlds of business, research, and civil society, we work flexibly to deliver effective solutions that offer people better prospects and sustainably improve their living conditions.

The Regional Fund for Triangular Cooperation with Partners in Latin America and the Caribbean was commissioned to the GIZ by the BMZ. Since 2011, Germany has been promoting the strengthening of triangular cooperation in Latin America and the Caribbean through the Regional Fund. It has established itself as a successful model recognized by all partners thanks to the interaction between the implementation of triangular cooperation projects, the development of management skills and the promotion of policy dialogue.

Triangular cooperations are projects which are jointly planned, financed and implemented by: (i) a soliciting partner, which has requested support to tackle a specific development challenge and which is an ODA-eligible country; ii) a pivotal partner, which has relevant domestic experience of addressing the issue in a context similar to that of the soliciting partner and shares its financial resources, knowledge and expertise; and (iii) a facilitating partner, which may help connect the other partners and supports the partnership financially and/or with technical expertise.

The Regional Fund operates on demand from beneficiary partners through biannual calls for proposals and focuses on promoting TrC with countries and multilateral partners “in” and “with” Latin America and the Caribbean. However, projects with partners from other regions are also possible and have shown successful experiences.

Partners include partner countries’ cooperation agencies, specialised sectoral organisations as well as governmental institutions, the private sector, civil society, academia and international organisations.

So far 36 countries have participated in a total of 128 projects, either completed or ongoing, taking on the role of pivotal and soliciting partners, including countries in Africa, Asia and the Middle East.



ARGENTINE COOPERATION

Argentine Agency for International Cooperation and Humanitarian Aid White Helmets, Ministry of Foreign Affairs, International Trade and Worship, Argentina.

Technical cooperation strengthens ties with other countries and builds a positive image of Argentina in the global arena, facilitating bilateral, regional, and multilateral negotiations, showing a reliable country with quality resources, experienced and respectful of the institutions of the countries with which it interacts.

Argentina's experience in the context of South-South and Triangular Cooperation has proven that, through dialogue and the search for complementarity, it is possible to achieve results with a social, economic, and environmental impact that led to well-being and progress in our societies. Thus, Argentina has established itself as a relevant actor in the field of Triangular Cooperation under the premise of building, from the South, a bridge across the diversity of paradigms and actors.

To such end, Argentina has the Argentine Fund for South-South and Triangular Cooperation (acronym in Spanish, FOAR), which over more than 25 years has established and developed partnerships for development. Its purpose is to build capacity through the sharing of knowledge, technologies, and best practices, as well as to create more dynamic development processes by means of technical assistance provided in the context of international cooperation projects.

There are currently more than 130 technical cooperation projects in different regions of the world. When other countries request an alliance with Argentina, these are the fields in which our country can offer added value: Agribusiness, Productive Technological Innovation/Science and Technology, Creative Industries, Environment, Health, and Human Rights.

In addition, and in terms of geographical distribution, Latin America and the Caribbean are the regions that has profited the most from cooperation. Over the past few years, Africa and Asia have become particularly dynamic, which has led us to increase our presence in Mozambique, Ethiopia, Kenya, Vietnam, among others.



Secretaría de Agricultura,
Ganadería y Pesca



Ministerio de Economía
Argentina



Ministry of Economy, Secretariat of Agriculture, Livestock and Fisheries, National Institute of Agricultural Technology, Argentina.

The Ministry of Economy works for an inclusive, productively dynamic, macroeconomically stable economy, with federal and sovereign equity. In this regard, the Secretariat of Agriculture, Livestock and Fisheries of Argentina, (acronym in Spanish, SAGYP) designs, proposes, and coordinates the implementation of policies, plans, programs, and resources related to agro-industrial producers, seeking the proper balance between productivity, sustainability, and territorial distribution.

Specifically, the Secretariat assists in strengthening the competitiveness of the productive sector, proposing measures of a global or sectoral nature that allow promoting its balanced and sustainable development; coordinates the preparation of proposals and the execution of policies for the regulation and supervision of agricultural production, articulating with the competent areas; understands the permanent updating of the national productive situation of agricultural crops, both intensive and extensive, of the dairy and livestock sector; participates in the definition of sanitary and technological policies linked to the dairy, livestock, agricultural and fishing sectors; participates in negotiations on setting tax and customs policies, as well as foreign trade related to the sector, in coordination with the competent bodies; makes proposals and coordinate the execution of policies for the production, promotion and control of forest-industrial resources, assisting in the monitoring of related markets and in commercial and sanitary negotiations of these items, in coordination with the competent areas of the Ministry of Economy. Likewise, the Secretariat, together with its decentralized organizations (INTA, INASE, SENASA, INV, INIDEP), is widely required by the Argentine Fund for International Cooperation to promote international technical cooperation projects to be implemented in different countries of Asia, Africa, Latin America, and the Caribbean.

The National Institute of Agricultural Technology (acronym in Spanish, INTA), founded in 1956, develops research and technological innovation actions within value chains, regions, and territories to improve the country's competitiveness and sustainable rural development. Its efforts are oriented towards innovation as a driver of development and integrate capacities to promote inter-institutional cooperation, generate knowledge and technologies, and make them available to the sector through its extension, information, and communication systems. Thanks to INTA's work, the country will have more potential and opportunities to access regional and international markets with high value-added products and services.

The commitment with the country and their international partners consolidates the role of INTA as the lead organization for development and generation of knowledge and technologies that fosters innovations to contribute of the competitiveness of agro-industrial chains, environmental health and sustainability of productive systems, social equity, and territorial development.

An aerial photograph of a tropical forest, heavily populated with palm trees. A dirt road winds through the center of the forest. A person is riding a motorcycle on the road, positioned in the lower-middle section of the frame. The entire image is overlaid with a semi-transparent green filter. The word "INTRODUCTION" is written in large, white, bold, sans-serif capital letters across the middle of the image.

INTRODUCTION

INTRODUCTION

Climate change has become a threat to the environment and non-renewable natural resources, mainly due to global warming and more frequent extreme hydro-meteorological events, such as storms and floods, draughts, forest fires and hurricanes, which day by day hinder economic development, affect food security, and contribute to the loss of biodiversity.

In this regard, the Food and Agriculture Organization of the United Nations advice climate change and the increasing intensity and frequency of natural disasters disproportionately affect Caribbean countries, influencing in their natural resources and livelihoods, such as fisheries, tourism, and agriculture (FAO, 2020). Specially, extreme hydrometeorological events such as tropical storms and droughts affects the availability and access to water resources as well as increase erosion and soil loss processes in Caribbean communities. Likewise, rising sea level could also intensify saline intrusion processes in coastal aquifers.

This situation aggravated by the disruptive effects of the COVID-19 pandemic raises permanently the need to strengthen the resilience of the agri-food systems of the countries of the region to the new climate, economic and health scenarios (CARICOM, 2020).

Therefore, sustained dialogues between government institutions in Latin America and the Caribbean and in coordination with partners of the European Union have increased.

In this sense, in 2018 a high-level political meeting took place in Barbados regarding agricultural matters. This encounter prompted a visit to Argentina integrated by eleven representatives from the Ministries of Agriculture of Caribbean countries, who were interested in having access to technologies that promote agricultural development and rural well-being in connection with food security and climate change resilience.

That same year, given the will of these countries to increase technical cooperation on common areas of concern, such as family farming challenges and sustainable use of natural resources, two technical workshops were held –one in Barbados and the other in Argentina– o define, refine and clarify the situations on the Caribbean Islands regarding governance of water and soil resources.

During the workshop in Buenos Aires, technical exchanges were developed on soil management, water resources, phytosanitary certification protocols and pest management, based on the interaction between professionals from the Caribbean and specialists from the National Institute of Agricultural Technology (INTA) of Argentina, the National Service of Agrifood Health and Quality (SENASA) of Argentina, the Inter-American Institute for Cooperation on Agriculture (IICA) and the Caribbean Agricultural Research and Development Institute (CARDI). As a result of the dialogue and understanding of the common problems, a draft International Cooperation Project was drawn up.

Specifically, the project intended to train leaders of the Caribbean countries (decision makers, water and agricultural agencies officials, professionals, and producers) in the water access management processes

1. Argentine Cooperation: On this occasion, this expression includes the articulation between professionals of the National Directorate of International Cooperation / Argentine Agency for International Cooperation and Humanitarian Assistance White Helmets of the Ministry of Foreign Affairs, International Trade and Worship of the Nation; the National Institute of Agricultural Technology, and the Secretariat of Agriculture, Livestock and Fisheries of the Ministry of Economy.

for multiple uses (human, domestic, agricultural and livestock consumption), validation of technologies, knowledge on soil erosion measurement and control practices, and the necessary laboratory techniques and equipment for their analysis.

In 2020, the Argentine Cooperation and the Ministries of Agriculture of Antigua and Barbuda, Barbados, Dominica, Grenada, Saint Kitts and Nevis, Saint Lucia, and Saint Vincent and the Grenadines presented a triangular project proposal to the German Agency for International Cooperation (Deutsche Gesellschaft für Internationale Zusammenarbeit- GIZ).

Having received the approval of the Regional Fund for Triangular Cooperation in Latin America and the Caribbean of GIZ in 2021, the regional project "Strengthening the management of water and soil resources for the sustainability of the agri-food systems of the Caribbean countries in the context of the COVID-19 pandemic" was initiated.

This Project is being carried out by the Ministries of Agriculture of Antigua and Barbuda, Barbados, Dominica, Grenada, Saint Kitts and Nevis, Saint Lucia and Saint Vincent and the Grenadines, the government of Argentina through the Argentine Agency for International Cooperation and Humanitarian Aid White Helmets, the Secretariat of Agriculture, Livestock and Fisheries and the National Institute of Agricultural Technology together with GIZ.

One of the main characteristics of this project is its triangular and regional nature. Across three geographic spaces: professionals from the Argentine Republic, provides technical expertise, for the generation of an exchange of experiences on agricultural innovations to the Caribbean with the support of the Regional Fund for Triangular Cooperation in Latin America and the Caribbean of the Federal Republic of Germany.

The project is structured in three main dimensions: strategic planning for land and water management and governance (regional report); trainings for sustainable soil and water management; and the setting up of demonstration sites or pots for water and soil management technologies and nature-based solutions in the Caribbean countries (Annex I: Project Summary).

This report compiles the problems, challenges and opportunities when creating new strategies for sustainable governance of natural resources in the Caribbean, describing, at the same time, an experience of triangular cooperation triggered by regional challenges.

Specifically, this publication contributes to the updating of strategic planning and technologies for governance on water and soil management in Caribbean countries, in the context of the post COVID-19 pandemic. The compilation of Chapters I to VII summarises the regional dialogue held through virtual and in site exchanges that have been organized to strengthen the articulation between the partners of the project between 2021 and 2023 (August).

In Chapter VIII, is an overview of the actions taken and the challenges for triangular cooperation for strengthening public policies and international cooperation for sustainable development.

In the conclusions, INTA's specialist highlighted some reflections about the implementation of environmental policies for the conservation and sustainable management of natural resources; the development of renewable energies and energy efficiency and the added value that the international cooperation promotes seeking innovation and sharing knowledge to reach new global public goods.



CHAPTER I

ANTIGUA AND BARBUDA

CHAPTER I - ANTIGUA AND BARBUDA



By Brent Georges

Government priority



- Food and Nutrition Security.
- Small scale Farming/Family Farming.
- Natural Resource Management and Risk Reduction.

“THE THREE GOVERNMENT PRIORITY AREAS CONSISTENT WITH THE CARICOM AGRICULTURE POLICY, OECS AGRICULTURE POLICY AND STRATEGIC PLAN, THE CARIBBEAN REGIONAL FOOD AND NUTRITION SECURITY POLICY AND ACTION PLAN, THE PLAN OF FOOD AND NUTRITION SECURITY AND THE ERADICATION OF HUNGER AND POVERTY OF THE CELAC” (FAO, 2017).

State of local situation regarding recent natural disasters and Covid-19 Issues



NATURAL DISASTERS



- Greater tendency for drought – extended dry season.
- Not much precipitation during hurricane seasons.
- Damage to infrastructure and plantations by hurricanes.
- Barbuda is still recovering from Hurricane Irma which hit in September, 2017.
- Antigua is also recovering from flood damage where bridges and roadways were washed away and damaged as well as soil eroded in many areas and are still rectified.
- Hydrometeorological extremes are intensifying.
- High intrusion of salinity into wells due to overuse of water supply to compensate for low precipitation (reduced water stored to be made available for use by the nation).
- Citronella grass, one of the most noted invasive species in Antigua and Barbuda, occupied over 345 acres of land and is constantly pushing out the native species from their natural habitats.

COVID-19 ISSUES



- Economic crisis.
- Limited financing.
- Restrictions on gatherings hampering practical trainings.
- High dependency on water due to increased agricultural activities and covid-19 protocol requirements.
- Increase demand for arable lands and water resources.
- Supply Chain Shortages.
- Local or regional protocols or manuals of Good Agricultural Practices due to COVID pandemic: available but not used.



General island situation on the governance of soil and water



- Currently, on average, the nation of Antigua requires approximately 7 million imperial gallons a day. Three types of water sources are used in water production in Antigua: the sea, surface water, ground water and meteoric/rainwater. The sea is all around the Island, surface water is from rain which gathers in ponds and dams, and ground water from deep within the earth, accessed through wells.
- Cost of implementation of technologies is high.
- The breakdown of the supply is as follows:
 - Reverse Osmosis Plants.
 - o The APUA Crabbs RO Plant – 3.1 million imperial gallons/day capacity.
 - o The APUA Camp Blizzard Plant – 600,000 imperial gallons/day capacity.
 - o The Fryes Beach Reverse Osmosis Plant – 600,000 imperial gallons/day capacity.
 - o The Pigeon Point RO Plant – 330,000 imperial gallons/day capacity.
 - o The Ivan Rodrigues RO Plant – 1.6 million imperial gallons/day capacity.
 - Water Treatment Plants.
 - o Delapps Water Treatment Plant – 1.5 million imperial gallons.
 - o Bendals Water Treatment Plant – 700,000 imperial gallons.
 - Ground Water.
 - o Well fields – 400,000 imperial gallons/day.
 - o APUA, rising to the increased need for water in Antigua has been expanding production capacity over the years. The newest additions to the water production system are the Pigeon Point RO Plant which adds up to 600,000 imperial gallons, and the Ivan Rodrigues RO plant (formerly Shell Beach RO plant) which adds up to 1.6 million gallons.
 - o Currently APUA has an agreement with Eneserve (now known as Sembcorp) to produce a minimum of 3.1 million imperial gallons. This agreement was originally signed in 1992 at a time when APUA did not have the technical abilities to operate a Reverse Osmosis Plant. The Authority has since over the past decade been able to upgrade its technical staff and abilities and has installed two reverse osmosis plants. These plants only operate when the need arises. Producing water via reverse osmosis is a costly venture which requires a large amount of electricity. APUA tries to rely on surface and ground water as much as possible given the inexpensive nature of its production. As a drought prone island, relying on surface and ground water often becomes difficult, this creates the need for reverse osmosis.





National and/or regional strategic policies or plans for the governance of natural resources



Sustainability of natural (land) resources:

Bush Fires Act (1901); Crown Lands Act (1917); Forestry Act (1941) and Regulations (1941 & 1952); Land Settlement Regulations (1952); Watercourses and Waterworks Regulations (1954 and 1961); Public Utilities Act (1973); Barbuda Local Government Act (1976); Physical Planning Act (2003); Barbuda Land Act (2007); Environmental Protection and Management Act (2015).

Soil management:

Crown Lands Act (1917) Forestry Act (1941) and Regulations (1941 & 1952); Land Settlement Regulations (1952); Watercourses and Waterworks Regulations (1954 and 1961); Barbuda Local Government Act (1976); Environmental Protection and Management Act (2015); Antigua & Barbuda's National Action Plan: Combatting Desertification, Land Degradation & Drought (2015-2020).

Water management:

Watercourses and Waterworks Regulations (1954 and 1961); Public Utilities Act (1973); Barbuda Local Government Act (1976); Wastewater Management Strategy for Barbuda (2008); Wastewater Management Strategy for Antigua (2008); Draft National Water Policy (2011); Roadmap Towards the Preparation of an Integrated Water Resources Management; (IWRM) Master Plan for Antigua & Barbuda; Antigua and Barbuda National Policy Statement.





Governmental information



Governmental agencies or companies that are responsible of gathering information about soils and assessing the land:

Lands Division, Extension Division, Livestock Division, Barbuda Council, Forestry Division, Environment Division, Department of Meteorological Services (DMS), Soil and Water Conservation Unit, Analytical Services Division (collect water samples for assessment – both public and private; fall under Ministry of Agriculture, Antigua Public Utilities Authority (APUA) also has testing facility only for supplies for public consumption.

Water agencies or authorities:

Water Division, Soil and Water Conservation Unit, and APUA water division that is mandated to provide potable water for residents in Antigua and Barbuda. They manage the distribution of water from all sources such as ponds, dams, wells, reservoirs, and the ocean. They also promote water conservation and rationing.

Water and Soil analysis:

- APUA.
- Analytical Services Division.

In 2014 the services of the Division were expanded to include operations at the Point Wharf laboratory facility in addition to their original lab at Dunbars Experimental Station.

Services Provided:

- Surveillance and monitoring of:
 - o Marine water quality.
 - o Potable water quality.
 - o Irrigation water quality.
 - o Food safety assessments.
 - o Soil fertility análisis.
 - o Plant pathogen screening.

Important: An audit was conducted recently; some equipment support to be obtained; presently preparing space for this installation to facilitate upgrade of laboratory.

Soil conservation practices of the producers

- Minimum tillage.
- Contouring of the land.
- Use of trees and grasses for slope management.

Practices on collective and/or individual water management that farmers and water agencies carry out:

- Drip irrigation.



- Green manure.
- Mulching (plastic and organic).
- Rainwater harvesting.
- Water storage (commonly plastic tanks 800 gal).

Problems/constrains for productive soil management:

- Need for policy/framework to address conversion of agricultural lands to housing/infrastructural development.
- More focus to be placed on the Agricultural community to meet water requirements and ensure food security.
- Threatened watersheds and water resources due to intensive and in some cases unregulated land use.
- Shallow soils with incipient development in some locations.
- Shallow and rocky soils on the northern side of the island. Three soil profiles: north – limestone; southern – volcanic and loam; central and eastern – clay. The volcanic soils are shallow. Volcanic soils include those from ash deposits (deep soils) and those which deposited over volcanic rocks; the latter are the shallow soils.
- Upgrade needed of technical capacity.
- Procedures, techniques, protocols, standards related to soil and water testing/analysis need to be established/improved as necessary.
- There is ongoing regional programmed to upgrade laboratories; Antigua is part of this (equipment).
- There is need for new reservoirs to store and supply water, expansion of existing water reserves and the creation of new water reserves.

Problems/constrains for water management:

- National Integrated water resource management policy needs to be updated.
- Aging infrastructure network and associated problems of encrustation, leakages and high-unaccounted for water due to corrosion.
- Inadequate network given the complexity of managing various sources that feed into the distribution and transmission systems for farmers.
- Faulty water meters that give rise to erroneous and inconsistent meter readings that impact billing.
- Inadequate water rate given the type of water that APUA distributes; farmers were given special rate, but this was not adhered to; 5 RO plants on island.
- Ground water use limited due to high risk of saline intrusion.
- Wastewater reuse is not practiced.
- Reverse Osmosis (RO) systems are used.
- Updated ground water surveys at national and regional level are needed.
- Need to find agriculturally friendly ways of disposing brine after RO process.
- Unfortunately, the services offered is inhibited by limited human resources. There is also need for upgrading of physical resources. There is need to increase the testing capacity to include minimum residue analysis and soil mineral content.
- Regarding human capacity building there is need for additional training on new techniques for irrigation management and soil and water management.
- Local Educational Institutions for training in Water and Soil Analysis: Critical area of need; there is need for more training of officers, and more systematic/continuous/consistent training of officers.



International Projects



- Consultancy for Rehabilitation of roads, streams, catchments (Ongoing – internal project of the Ministry of Agriculture).
- Environment Division ongoing project of similar scope to the above.
- Improved Soil and Water Management in Bendals Community (linking farmers, forestry, community to improve livelihood through incorporation of tourism). Includes water distribution/management improvement; also receiving funding from UNDP potentially. Anticipated to eventually be island wide. Seeking a trusted association to do the implementation. Project concept is presently being developed by officer within the Ministry.
- Water Energy Food Nexus project sponsored by FAO and AMEXCID. (Teaching farmers how to use solar powered pumps to irrigate fields by incorporating use of tensiometers to determine irrigation rate as a means of water conservation; farmers also to receive plastic water tanks and water bladders) – ongoing.
- Integrated Land Management Project (executed in Bendals by Forestry Division) – Triangular Cooperation Project is contributing to this project (ongoing).
- Lemongrass management project on nearby slope.
- CSIDS Soil Management and Integrated Landscape Restoration and Sustainable Food Systems (PSILM) – Soil testing throughout the island – 120 sites; 61 in Antigua and 59 in Barbuda (ongoing June 5th to 23rd Soil Sampling – 4-year project).
- Morocco Soil Fertility Mapping Project (ongoing – stalled).
- “Strengthening water and soil resource management for the sustainability of agro-food systems in Caribbean countries in the context of the COVID-19 pandemic” with German and Argentine Cooperation (2020-2023).





Antigua and Barbuda needs for the sustainable management of water and soil resources.



SHORT TERM

- Strengthening capacities of water authority.
- Upgrade regulatory frameworks for water management.
- Create decision supported systems available to public and other stakeholders.
- Strengthening capabilities of Ministry of Agriculture's Land and Water Units
- Research most sustainable alternatives for brine deposition/destination.
- Farmer awareness of soil sampling and interpretation
- Promote soil conservation techniques especially in zones with steep slopes e.g., terracing, contour drains, complemented with reforestation with specific/proven species.
- Conduct research and development reference soil degradation, development of protocols.
- Need for OECS/Regional protocol for soil research; research to include soil losses rates, soil erosion risk mapping, database of soil and water.
- Soil quality improvement: soils are largely polluted e.g., in pineapple cultivation, agrochemicals have compromised quality of soils. Need to take corrective measures to improve soil quality/correct balance of nutrients. Incorporate soil restoration using methods suitable to the needs of the site, e.g., use of bioremediation using plants, bacteria, and fungi.

MEDIUM TERM

- Strengthening capacities of water authority.
- Creation of more potable and more affordable water for the farming sector.
- Implementing research and developing technology and/or programs to increase efficiency in water use and production in the agricultural sector, to increase and enhance soil and water use and management.
- Strengthen new water paradigms and inclusion in water management e.g., water NEXUS, water efficiency initiatives, promotion, and implementation of nature-based solutions to enhance adaptation capabilities, enhance water quality and availability and promote reuse of wastewater.
- Development of adequate water policies supported by appropriate legislation.
- Commissioning of an Integrated Water Resources Management Agency.
- Incremental annual expansion for source and supply development to meet needs.
- Replacement of ineffective pipeline systems.
- Ensure improved financial viability of APUA's Water Division.



CHAPTER II

BARBADOS

CHAPTER II - BARBADOS



By Glenn Marshall and Beverly Wood

Government priority



The Ministry of Agriculture, Food and Nutritional Security's key objectives (2022) include the following:

- Facilitate the increase in domestic food production by 5% to reduce the agricultural component of the food import bill by 25% by 2025.
- Increase opportunities for individuals to participate in the agriculture sector by providing land, water and start-up resources.
- Increase sale of local and regional products by providing marketing support and strengthening the links in the food chain.
- Increase competitiveness and competence of producers to achieve the national agricultural targets.
- Conduct climate smart research to provide solutions that will help farmers increase their output.
- Facilitate access to agricultural insurance and provide soil management solutions.
- Enforce a robust food safety, plant and animal health and welfare system and provide laboratory services in accordance with the law and regulatory framework.





State of local situation regarding recent natural disasters and Covid-19 Issues



NATURAL DISASTERS

- Barbados is prone to strong storms and hurricanes in its rainy season from July to November although most systems fortunately veer north or south of the island. The last significant hurricane was Hurricane Elsa in 2021 passing just south of the island but the last major hit was Hurricane Janet in 1955 which inflicted serious widespread damage. A strong Tropical Storm Thomas in 2010 damaged homes and downed power lines then went on to become one of the largest hurricanes on record in the Atlantic. Flashflood occurrence in many areas of the island. Watercourses can experience very rapid runoff, soil erosion and high sediment load, affecting water quality.
- Agricultural drought is sometimes experienced. The Barbados Water Authority for a few months in 2023 had to implement a prohibition on potable water use (such as irrigating gardens and lawns by hose or sprinkler, etc.), aimed at conserving water as drought-like conditions persists. Persons faced fines of a fine of US\$250 or one month in prison. The island experienced drought-like conditions in 2016, 2018 and 2019.
- Barbados is not volcanic but as recently as April 2021 experienced severe volcanic ash fall (from the La Soufriere Volcano in St Vincent) which disrupted economic activity and impacted livestock and pasture production on the island.
- There are many earthquakes recorded around Barbados, but the majority are small enough not to be felt by residents. The most significant earthquake since 1900 was in November 2007 with a magnitude 7.4 on the Richter scale. Though there was no infrastructural damage, Barbadians were reminded that the island is in an earthquake zone.
- The University of the West Indies' Seismic Research Centre has the responsibility for monitoring and studying earthquakes, volcanoes, and tsunamis across the Eastern Caribbean.
- The Department of Emergency Management is the government department responsible for the development and implementation of the emergency management program in Barbados.
- The Caribbean Disaster Emergency Management Agency (CDEMA) is the regional entity tasked with coordinating disaster response to member countries the Caribbean region.

COVID-19 ISSUES

- Coronavirus (COVID-19) has had major impact on the islands economy during its peak in 2021 and 2022 with the shutdown of the international tourism sector (our key foreign exchange earner) and a national shutdown of business. The islands economy lead by tourism is recovering.
- Projects focused on small farmers developing, having, or providing entrepreneurship. Those projects are focused on people who have lost the jobs due to Covid and other economic problems in the country. Projects consist of providing land as well as some startup equipment and materials for agricultural production.



General island situation on the governance of soil and water



- Barbados Water Authority is the overall guidance on water resources in Barbados and this includes the agricultural component. Most of the water used on the island is abstracted from ground water aquifers with smaller amounts from springs.
- A significant amount of water that is used by the agricultural sector comes from the potable water supply. We have an excellent potable water supply distribution across the country and many small farmers and agricultural interests use that potable water supply, for agricultural purposes.
- Since the 1980s, the government, through the Ministry of Agriculture, has had an irrigation scheme providing dedicated water to small farmers. It consists of several irrigation districts across the country. That water is cheaper than the potable water supply and a lot of farmers use it whenever is available in their districts.
- There are two main sewage treatment plants in Barbados: on the south coast and in the capital Bridgetown. These are many years old, and the government is looking to rehabilitate and upgrade them.
- A few small rivers have a base flow that can provide some type of water during the dry season. Most rivers on the island run dry in the dry season. Flash floods could occur during the peak rainy season, which usually is in September and October. There are some Acts that govern the springs or streams in Barbados and the main one is the Three Houses Spring Act from 1713 and the Porey Spring Act 1864. The former was recently repealed with Three Houses Spring (Management and Control) Act, 2023.
- The Barbados Water Authority provides abstraction licenses. The concern right now is that there is little monitoring of agricultural abstraction to verify that water users are adhering to the conditions of the license. Barbados since the 1960s has implemented a system of zoning around the abstraction wells used for by the Barbados Water Authority for potable water. The zones limit commercial, agricultural, and other operations to protect the water quality.
- Overall, in terms of development in the country, there's a Physical Development Plan. The Plan is intended to provide a vision for sustainable growth and development of the nation by setting out policies to guide relationships among land uses, built form, mobility, community facilities and physical infrastructure.





National and/or regional strategic policies or plans for the governance of natural resources



Sustainability of natural (land) resources:

- Barbados Water Authority Act.
- Underground Water Control Act.
- Prevention of Floods Act.
- Water Protection and Land Use Zoning Policy, 2020 Green Paper.
- Plant Protection Act.
- Town and Country Planning Act.
- Protection of New Plant Varieties Act
- Agriculture & Climate Change Policy (draft 2022).
- Agriculture & Renewable Energy Policy (draft 2021).
- Barbados National Action Programme to Combat, Desertification and Land Degradation, and to Mitigate Against the Effects of Desertification, Land Degradation and Drought (2002 Working Draft).
- Barbados National Park Plan.

Soil management:

- Soil Conservation (Scotland District) Act
- The Physical Development Plan
- Trees (Preservation) Act
- Cultivation of Trees Act
- Livestock (Control of Strays) Act

Water management:

- The National Plan of Barbados includes sustainable water and soil management and agricultural water. Barbados Water Authority provides guidance on managing all the water in the country from the national point of view, through the Underground Water Control Act, Flood Prevention Act, the Water Protection and Land Use Zoning Policy, etc.
- The Ministry of Agriculture is in the process (2021) of developing a draft vision framework for the agricultural sector. An important point to consider is the intention to separate the gardener from the agricultural business type person. The ministry is also in the draft stages of designing an agriculture and renewable energy policy.
- There is also a national erosion control and aquifer recharge program. The majority of Barbados is limestone, karstic limestone, and it has several groundwater wells across the country. Most of the farm water and agriculture comes from these wells, directly for agriculture, or indirectly through the Ministry's operations. The Barbados Water Authority also uses ground-water aquifers and streams to pump potable water for different purposes across the island. It is highlighted that there are projects that are looking to protect those wells.



- Some very old Acts govern the springs or streams in Barbados and the main one is the Three Houses Act from 1713 which was recently repealed and replaced by the with Three Houses Spring (Management and Control) Act, 2023 to allow the Barbados Agricultural Development and Marketing Corporation better governance of the area.

Governmental information



Governmental agencies or companies that are responsible of gathering information about soils and assessing the land:

On the legal and institutional side:

- Ministry of Agriculture, Food and Nutritional Security: including the Soil Conservation Unit.
- Ministry of Transport, Works, and Water Resources: including the Barbados Water Authority.
- Ministry of Environment and National Beautification: including the Environment Protection Department and the Natural Heritage Department.

Water agencies or authorities:

- Barbados has been classified as one of the 15 most water scarce countries.
- The Barbados Water Authority has overall responsibility for water resources development in Barbados including policy, monitoring, management, potable water distribution.
- The Ministry of Agriculture through its Barbados Agriculture Development and Marketing Corporation (a state operating enterprise) inter alia, manages the government's 12 small farmer Irrigation Districts. These pressurized irrigation systems provide non-potable water to 600 small-farmers across the island.
- The Environmental Protection Department is responsible for environmental protection, including water, water bodies, etc.
- The Barbados Meteorological Services (BMS) maintain a network of automatic weather stations across the island. The Ministry of Agriculture is looking collaborate with BMS and the locally based Caribbean Institute for Meteorology and Hydrology in going to the next stage of being able to interpret agro-meteorological information for small farmers and make it available to the public through apps.
- Surface water is now scarcely used. There are some ongoing projects for rainfall harvesting and storing surface water runoff from small watercourses and streams that run off during heavy rain events.
- There are no water users associations. However, the Barbados Agriculture Society represent the interests of the agricultural sector in all relevant forums. There are a few farmers cooperatives, but they're usually not very active.



Water and Soil analysis:

- The Government Analytical Services Laboratory (of the Ministry of Agriculture) does analysis of water, soil, and plant tissue.
- It is necessary to acquire equipment for the Ministry of Agriculture's Lab. Training is also required for Extension Officers and to be able to advise the farmers on interpretation of the results.

Soil conservation practices of the producers

- There's a Soil Conservation Unit (within the Ministry of Agriculture) that concentrates efforts in the Scotland District area (1/7 of Barbados land area), affected by significant erosion problems in land slippage. Some of the technical practices applied there are: terracing and engineering structures, using gabions for retaining walls and weirs to control erosion.
- Good practices in land use and soil management: The Ministry of Agriculture has been pushing conservationist agricultural practices like minimum tillage, mulching and other techniques to reduce the runoff and erosion and soil degradation. Due to use of tractor cultivation, some areas are affected by hardpan occurrence (affecting the root penetration). There is a national project ongoing with the Barbados Agricultural Management Company to address these matters particularly in sugarcane fields. There is routine application of fertilizer across the island, most often chemical fertilizer, which is mainly nitrates and nitrogen and phosphorus. Barbadian soils, because of the calcareous nature, mop up the phosphorus, so there's interest about the microflora and if it is available to cause the release of phosphorus from the soil. One of the traditional practices, after the harvesting (particularly of the sugarcane), was to add organic matter either from animal manure or muds and soil from the factory, but that has decreased over the years and therefore our organic matter is generally quite low.
- The primary work on soils in Barbados was "Soil and Land-Use Surveys 18 Barbados by Vernon and Carroll" in 1966. Today there is renewed interest in soil analysis but there's a lack of capacities to interpret the data and to advise the farmers as to what they would need to do. This is an opportunity for cooperation for the agronomic section within the Ministry.
- The Ministry is also reintroducing the use of Khus Khus grass (*Vetiveria zizanioides* L.) to try to reduce soil erosion across the island. Barbados does not have the types of extremely hilly terrain all over like a Dominica or Saint Vincent, but in the Scotland District there is significant erosion and degradation.
- There's a lot of interest in any technologies to improve the rhizosphere, plant-microbe interaction, to enhance soil-plant performance.
- In Scotland District area there are sand deposits (from the sand dunes in the Saint Andrew area) which is used in building construction and which have been mined for decades as a sand quarry. The private company Walkers Institute for Regenerative Research, Education, and Design (WIRRED) has turned the 200+acre quarry area into the largest regeneration project on the island developing a natural reserve and living laboratory for climate resilience.



Practices on collective and/or individual water management that farmers and water agencies carry out:

- Interest to study and develop some storm water runoff reservoirs in different parts of the country.
- Successive governments have invested much capital in developing and maintaining significant irrigation water supply infrastructure dedicated for farming. Several parishes across the island have dedicated irrigation infrastructure since 1980s-1990s. The water is metered, and users are billed monthly at a subsidized rate. More recently 2022, a prepaid system has been introduced (as a pilot project) to help avoid accumulation of arrears.
- It is important to move to the stage of e-agriculture in terms of communicating with the farmers.
- Most farmers now use drip irrigation. It has taken 30 years promoting by the Ministry of Agriculture. However, it is desirable to move to the next stage where the farmers become more water quantity conscious, using the water more efficiently and to use fertilizers through the irrigation system. It requires a certain type of training for the farmers, for extension people to move to that next level of more efficient use of the resource. Use of irrigation timers, tensiometers, etc. are promoted.
- The Ministry of Agriculture is working on irrigation water augmentation over the next two to four years. About ten reservoir projects are planned across the country for irrigation purposes.
- The decision has been made to pursue the reuse of water from municipal sewage treatment facilities on South Coast and our Bridgetown system when they undergo upgrade and rehabilitation over the next few years. The Ministry of Agriculture needs specific assistance in the developing a strategy for the use and monitoring of this treated water by the farming community.
- The Ministry of Agriculture operates five (5) agricultural stations.

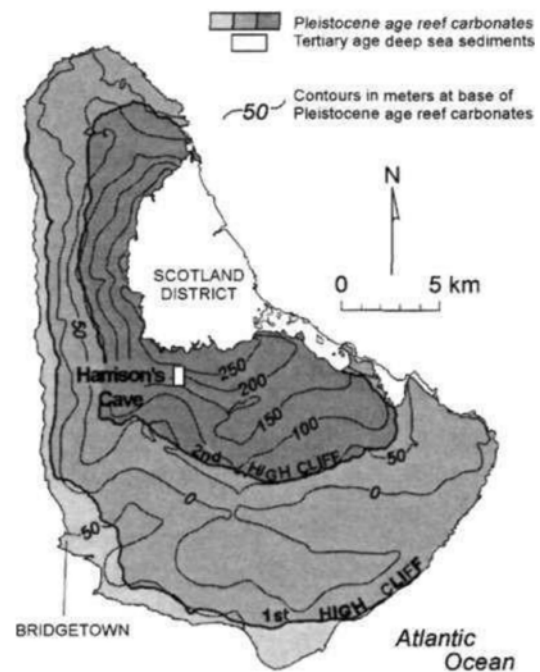
Problems/constrains for productive soil management:

- Erosion in some areas, particularly in Scotland district.
- The loss of arable agricultural lands to other uses has continued over the years. The Physical Development Plan is a comprehensive land use policy introduced since the 1970s. It inter alia seeks to control and reduce the change of use of land use from agricultural to other competing uses such as industrial, housing, etc.

Problems/constrains for water management:

- Significant amount of water used by agricultural sector is from the potable water supply distribution which is across the country. Many small farmers and agricultural interests use this water supply, which also includes groundwater. The Ministry of Agriculture is in the process of developing draft Visual Training Workshop for Agricultural Sector, with key focus being separating the backyard gardener from the bigger agricultural business-type person, who is focusing on food security.
- Some barriers for long-term effectiveness and efficiency, irrigation, or availability where they have these projects now that are trying to increase the amount of stored water.

- That is also within the Ministry of Agriculture. A lot of the staff is 55+ and the number of younger persons coming in, qualified persons to carry on, is limited. Over the past years, the numbers within the Ministry have also dwindled due to problems in the economy impacted on by global events. In general, The average age of the farming community is increasing.
- Water quality issues when water is sourced directly from storm water runoff (high bacteria load, presence of oil) requires a careful use of that storm water runoff.
- Water harvesting is on the increase. It is mandatory when building new houses and structures nowadays, is law that you must have some type of water storage capacity depending on your roof area.



Barbados: 13° 7'24.74"N 59°33'4.85"W

International Projects



- Irrigation and water infrastructure projects for two of the driest areas in Barbados – St Phillip and Spring Hall. Both already have irrigation projects and infrastructure but there are extremes at different times of the year. These range from flooding to lack of sufficient water, depending on seasons. This project will have multiple phases over multiple years. First phase has USD 3 million to work with and as work progresses, then there will be application for more funds for the rest of the phases.
- National tree planting program. The objective there was to plant up a million trees across the landscape of the country for carbon sequestration benefits as well as soil conservation and beautification of the areas. This program was offset significantly by the Covid-19 Pandemic and the shutdowns that we've had and gone through the country. The program is ongoing, but at a much slower pace.



- The decision has been made to pursue the reuse of water from the Barbados Water Authority's municipal sewage treatment facilities on South Coast and our Bridgetown system when they undergo upgrade and rehabilitation over the next few years. So far, a US\$39million grant has been received from the Global Climate Fund to upgrade one of the facilities. This treated water will be used for agricultural irrigation and groundwater aquifer recharge.
- The Lears Urban Land Lease and Food Security Program is a public-private partnership venture and that provides irrigation water and land lease opportunities for small and micro-farmers (a quarter acre, half-acre parcels) across 70 acres. It was commenced in 2022/23.
- Barbados participates in a Mexico/CARICOM/ FAO Initiative "Cooperation for adaptation and resilience to climate change in the Caribbean" sub-project with Antigua/Barbuda, Jamaica and St. Kitts/Nevis titled: "Increasing the resilience of the SIDS Caribbean through the Water Energy Food Nexus in Agriculture". The project aims to improve water



resource efficiency for improved food diversity in the Caribbean SIDS using an integrated approach to water, soil, nutrient and energy management. The project will foster integrated solutions around the Water-Energy-Food nexus approach in the Caribbean countries using technological innovations, such as solar powered (micro-) irrigation systems to improve water efficiency and management (ex. hydroponics and rooftop water harvesting) and access to clean and climate-smart energy (solar and wind), to produce healthy and fresh foods in both peri-urban and rural areas.

- Barbados participates in a Triangular Cooperation Project “Strengthening water and soil resource management for the sustainability of agro-food systems in Caribbean countries in the context of the COVID-19 pandemic”. The project receives funding from Germany and technical expertise from Argentina to support Barbados and 5 other Caribbean islands (2020-2023).
- Barbados also participates in a “Mapping Soil Fertility for Durable Agriculture in Barbados” Project supported by the Kingdom of Morocco. There are 8 key work packages including the following: Soil fertility assessment and mapping, Developing fertilizer recommendations for a major crop, Developing a soil fertility information and expert system, Training and human capacity building, Technical Capacity building, Results communications, and Monitoring.
- Barbados and six (6) other CARICOM countries participate in the project titled “Caribbean Small Island Developing States (SIDS) Multicountry Soil Management Initiative for Integrated Landscape Restoration and Sustainable Food Systems: Phase 1 (or CSIDS-SOILCARE Phase 1)”. The project’s objective is to Strengthen Caribbean SIDS with the necessary tools for adopting policies, measures, and reforming legal and institutional frameworks to achieve Land Degradation Neutrality and Climate Resilience. This is a Global Environment Facility funded project with UN-FAO as Implementing Agency.



The regional executing entity in the Caribbean is the Partnership Initiative for Sustainable Land Management (PISLM) based in Guyana. There are five (5) main project components as follows:

- Component 1: Strengthen national and regional soils information, technical capacity, and coordination as a Basis for Improved Decision Making Including on Sustainable Soil Management (SSM), climate smart agriculture and Land Degradation Neutrality (LDN)
- Component 2: Addressing the Drivers of Land Degradation Through the Rehabilitation of Land and Soil Degraded Areas and the Promotion of Integrated Landscape Management and Restoration
- Component 3: Resilience Building to land degradation, Natural Disasters and Climate Change through Climate Smart Agriculture and Enhanced Drought Risk Management
- Component 4: Enhancement of Food Systems and Alternative Livelihoods through the promotion of innovations in agriculture and livestock production systems and Mobilization of the Private Sector in Support of LDN
- Component 5: Monitoring and evaluation, knowledge management and communications.



Barbados needs for the sustainable management of water and soil resources.



SHORT TERM

- The Ministry of Agriculture needs assistance/training in GIS and digital mapping, agricultural drone applications use, data acquisition/processing for agriculture, and sustainable soil management.
- Training in the interpretation of soil sample results for providing advice and information to small farmers. (Use of app to inform it).
- The Ministry of agriculture needs the services of a Soil Scientist. Such expertise has not been on staff at the Ministry for over 15 years.
- Assistance is needed in conducting cost benefit analysis prefeasibility studies for development of relatively large irrigation ponds (about 60 Million Gallons) in the north of the island. The Ministry of Agriculture has the results of two (2) hydrogeological studies indicating good potential for such development using surface runoff from large catchment areas.
- The Ministry of Agriculture needs technical expertise regarding use and management of treated sewage effluent for reuse for small farmer agricultural irrigation with related setting up of water quality monitoring program for crop, soil, and ground water protection. It is expected that in a few years this source of water will become available to the agriculture sector with the upgrade and rehabilitation of municipal treatment plants.
- Assistance in the development of an agricultural water use management policy as well as a development and implementation plan.

MEDIUM TERM

- Construction of large water storage ponds/reservoirs and related distribution systems for agriculture irrigation purposes in the north and east of the island.



CHAPTER III

DOMINICA

CHAPTER III - DOMINICA



By Ryan Alsem and Al-Mario Casimir.

Government priority



- Food and nutrition security, agricultural health, and food safety.
- Risk management, building resilience to climate change and ecological sustainability.
- Sustainable agricultural and rural development.

“THE THREE GOVERNMENT PRIORITY AREAS CONTRIBUTE TO THE COUNTRY’S STRATEGIC DEVELOPMENT GOALS OF ECONOMIC GROWTH AND SUSTAINABLE DEVELOPMENT”
(FAO, 2017).

State of local situation regarding recent natural disasters and Covid-19 Issues



NATURAL DISASTERS

- Dominica is at risk to earthquakes and volcanic eruptions, flood and landslides, and hurricanes (Climate Change Knowledge Portal, 2021). Also, the impact of global warming on rising sea levels increases the risk of storm surges, and the power of hurricanes.
- According to the Climate Risk Index, Dominica was the country with highest GDP losses to climate-related natural disasters during 1997-2017, and among 182 countries, was in the top 10 percent of climate-related disaster fatalities (IMF, 2021).
- In 2017, Hurricane Maria devastated the island with an estimated loss and damage of 226 percent of GDP, following soon the heels of damages from Hurricane David (1979) and Tropical Storm Erika in 2015 (IMF, op. cit.).

COVID-19 ISSUES

- The Covid-19 pandemic caused significant economic and social hardship owing to Dominica’s dependence on tourism receipts, which plummeted in the wake of the pandemic leading to a sharp decline in tax revenues. At the same time, Dominica was forced to increase and reprioritize public spending to address immediate health needs and make transfers to the unemployed (IMF, op. cit.).



General island situation on the governance of soil and water



- Dominica is very much high rainfall country. We experience rainfall more than 10,000 millimeters per annum in the most intense rainfall areas in the central part of Dominica.
- Agriculture to a greater extent has always been rain fed and the whole concept of irrigation schemes is something very novel to us.
- The area of governance is critical. The area of governance and how actors move forward in terms of relativity framework because some of their actions and even the actions of the farmers are not legislated. Extension officers can't tell a farmer what to plant, what they may recommend, but there's not a legislative power mandate to enforce some of the recommendations. We must have some harmonized standards and protocols on how we move forward.
- Water management is essentially governed by the Dominica Water and Sewage Company called DOWASCO. It is a registered company owned by the government of Dominica, established by the Act of Parliament in 1989. Prior to that, the company was called the Central Water Authority.
- DOWASCO, is wholly responsible for the management of water and water resources in the country. It was established by the Act of Parliament and there is a Water and Sewage Act, Chapter 43:40 of 1989, which gives the company exclusive license regarding the water resources of the Commonwealth of Dominica.
- Again, as way back as 1967, there was a Central Water Authority Act, which has been repealed by current legislation. But all of them are seeking to protect the resources of Dominica.
- Dominica is blessed for having a significant amount of surface water. We boot up ourselves of having 365 rivers, and, to a lesser extent, farmers try to take advantage of that resource space in terms of irrigation systems.
- There's a price differentiation in terms of the water rights for the use in agriculture as well as for domestic consumption. There's an issue with regards to the quality and the quantity of water for agriculture, linked to the use of chlorination agents. It has been problematic with regards to the buildup of salts in the soil base.





National and/or regional strategic policies or plans for the governance of natural resources



Sustainability of natural (land) resources:

- The Triangular Cooperation Project is timely, and this is compatible and complementary with current initiatives. The Ministry is at a transformational stage - working with Food and Agriculture Organization (FAO) to finalize the agricultural policy and implement transformational actions within the agricultural sector.

Soil management:

- Soil acidification and how we curb that, the issue of land degradation, the use of soil sealing, the whole issue of carbon sequestration, the retention of soil organic matter and all these key issues as it relates to improve management of soil will become part and parcel of our discussions.
- Ministry is working with the Physical Planning Department and the Physical Planning Division under the Land Use Policy with regards to upgrading its land classification systems for agriculture. This classification systems in terms of soil fertility maps are very much outdated as done in the 1967. Ministry is making a soil classification exercise, which was conducted for most of the eastern Caribbean islands, to upgrade information about the soil fertility mapping. But nonetheless, they are concurrently working with the Physical Planning Department in terms of reviewing and or upgrading their agricultural land classification systems, paying particular attention to topographic and classifications. Ministry has asked for permissible maximum permissible slopes.

Water management:

- The physical planning division, the overall executive arm of the government which is responsible for the land and physical resources. But with regards to the water management per se, it solely rests within the ambit of the DOWASCO.





Governmental information



Governmental agencies or companies that are responsible of gathering information about soils and assessing the land:

- Most of the islands don't have up-to-date soil maps. Technical instances are currently undertaking a reclassification and renaming exercise of soils to keep in tune with the International Nomenclature. Those instances have limited advances in terms of comparisons and sharing of information. So that exercise is part of a nationally funded project under the Dominica Disaster Vulnerability Reduction Project (DRVP), and that assistance is being funded through the World Bank.
- There's analytical capacity within the Dominican contingent with regards to soil analysis. The ministry has state-of-the-art equipment to include atomic absorption spectrometers, etc. But capacity building is challenging with regards to the quality and the competencies of all human capacity so that is all warranted in terms of ongoing training.
- Regards to the government agencies or companies that are responsible for gathering information about soils, become aware that Dominica has a Physical Planning Act No. 5 of 2002, which provides for orderly and progressive development and land use both in terms of the urban and rural areas. The National Land Use Policy of 2014-2016 gives further insights in terms of the management of that process in terms of it enables effective land use planning in a coordinated and structured matter in terms of improving the Physical Planning divisions' responsibility in terms of land management issues.
- Nonetheless, the Lands and Surveys Division of the Ministry of Housing and Urban Development is the legal custodian of all government land records and provides high-quality regulatory information in terms of managerial services and policy advice in terms of public and private land use.
- The Lands and Surveys Division is vested with the responsibility for creating National Land Information Management and Mapping Systems as well as advising with regards to agricultural and industrial land development. That responsibility is vested in terms of the revised laws of the Commonwealth of Dominica of 1990, as stated in chapters 51.01 of the State Lands Act, as well as the Land Service Act, of Chapter 53.04. So, in a sense, the laws provide the legal framework for the lands and service divisions with regards to the administration of all state lands.
- Nonetheless the Technical Services Division of the Ministry of Public Works and Digital Economies also conducts several engineering and road services, and it laces with other ministries in terms of development of land management maps. The Physical Planning division of the Ministry of Economic Affairs, Planning, Resilience and Sustainable Development also covers a range of land use and development issues to include the compilation and the statistical analysis of land use data.

Water agencies or authorities:

- The ministry has conducted some work with the Disaster Vulnerability Reduction Project (DVRP) as funded by the European Union in doing some lighter work with regards to some bathymetric work as well as some terrestrial LIDAR imagery, so we have that data set available. The surveys were completed, and the information is presently available for use within complementary projects.



Water and Soil analysis:

- About laboratory capacities: there's interest in developing soil erosion maps.
- The Dominica Bureau of Standards offices is located at the National Centre for Testing Excellence (NCTE) Building in the Stock Farm, the Customs Building, and Woodbridge Bay, Roseau, and Longhouse, Portsmouth. The NCTE is a multipurpose laboratory that is divided into two main laboratories. One looking at microbiology and the other looking at chemistry. And within the Chemistry Department there we do some analysis of soils, including heavy metals and fertility parameters.
- DOWASCO: doing several laboratory issues in terms of specialized laboratory testing for water quality.
- As recent as two months ago, partnership with the Dominica Export-Import Agency where the ministry did an island-wide soil survey looking at heavy metals with regards to production. So, it was looking at cadmium and technical officers would like to expand that analysis to include other heavy metals such as arsenic and lead.

Soil conservation practices of the producers:

- The ministry favors the sloping agricultural land technologies as one of the technologies that officers try to push forward.
- There are some demonstration plots located in the central area where officers are incorporating the utilization of grass barriers to include Vetiver, the development of windbreak systems as well as the establishment of permanent terraces and the development of contour farming systems. The further development of Vetiver in the southeast part of the country is a response to the very steep topography that conditions farmers' activities.
- The development of agro-forestry systems to include non-corrupt and forest timber species is very relevant to the Dominican farming system.
- There is a very high inclination towards the adoption of organic agriculture.

Practices on collective and/or individual water management that farmers and water agencies carry out:

- There were significant investments through the Banana Industry Trust in terms of the development of on-farm irrigation systems across certain banana attachment growing areas. Unfortunately, none is in commission as it was mentioned. So, farmers, particularly vegetable farmers, have resorted to the use of micro irrigation systems.
- Manual irrigation is the main water management practice. It is a very labor intensive. On-farm rainwater harvesting systems to include the use of 45-gallon drums and more.
- In recent times, micro irrigation systems to include the use of sprinkler drip and fertigation systems more so in greenhouse conditions.
- There are not actually surface irrigation systems because the topography of the island doesn't permit such.



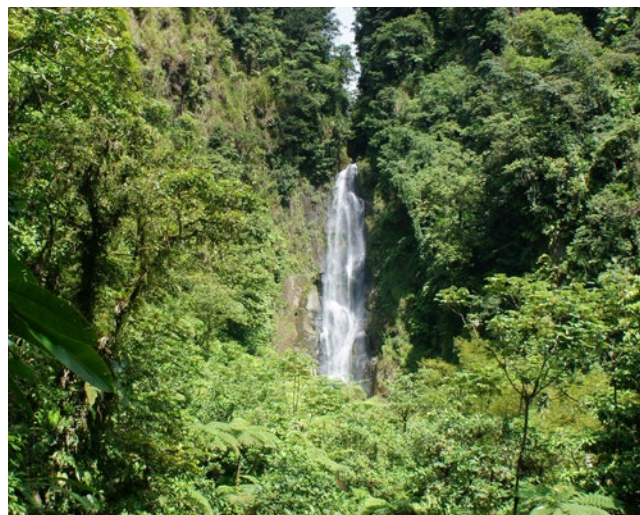
Problems/constrains for productive soil management:

- The issue of water storage is critical pre- and post-disaster. For example, the situation provoked because of the occurrence of Hurricane María. Dominica has 365 rivers and about three water plants, but potable water for drinking is an issue. Every time the region has a natural disaster (storms, earthquakes), it is necessary to look at the water storage for drinking and agricultural use, both instances pre- and post-disaster.
- The issue of land classification, slope stabilization and soil conservation are of extreme importance based on the topography and the nature and which farmers carry out agriculture. Dominica is a very mountainous island, the most mountainous island in the eastern Caribbean, so soil conservation is a key aspect for planning. So critical to the agricultural sector is slope stabilization, and the ministry is in work with IICA in doing some eco-based approaches in terms of slope stabilization with the use of vetiver as a grass barrier.
- A lot of our farming is done on hillsides, and slopes more than 30 degrees are very predominant on the landscape of Dominica.
- Open rainfed agricultural systems and such that has led to an increased use and a dependency on mineral fertilizers; thus, increasing the risk of soil erosion, acidity of soils.
- Average soil pH is highly acidic: 5.5. Farmers are increasingly dependent on mineral fertilizers to try to increase productivity and exacerbating the whole issue of soil acidification.
- To compound, farmers have the cultivation of strip slopes where the natural vegetation is gradually being eroded in terms of opening new lands and hence trying to increase productivity on marginal lands or even lands which are not adequately suited for agriculture. And hence the frequency and increased use of tillage operation is exacerbating the problem of soil structure.
- With regards to ministry's attempts in terms of demonstration plots, ecosystem-based approaches are favored with regards to our hillside farming technologies.
- With high rainfall and steep slopes, soil conservation is significant; this was manifested during given past disasters.
- With regards to soil management problems. Dominica is volcanic in origin and as such the farming sector has an issue with phosphorus. Phosphorus fixation based on the high content of aluminum and iron oxides is very much a limiting factor with regards to agronomic performances in subsoils. Nonetheless the higher rainfall patterns of the country in excess of 10,000 millimeters per annum in the higher interior rainfall areas is problematic with regards to soil erosion challenges as well as the increase in anthropogenic interference with regards to soil degradation because slopes in excess of 30 degrees are formed in almost 60% of the land with regards to agricultural land use and hence a very significant small percentage of the land is actually stood for agriculture, less than 20%; although an estimated 25% of their land is actually being used for agricultural purposes. And hence the risk of soil erosion and deterioration of soil structure, soil fertility and as well as hydrological impacts is very significant and pronounced.



Problems/constrains for water management:

- Unfortunately, most of the irrigation systems have been decommissioned due to the ravages of Hurricane Maria the island experienced in 2017.
- Ministry has issues with regards to the affordability and the replacement of parts and equipment specifically for irrigation systems. A lot of that has been damaged when Hurricane Maria hit the region, and farmers have not been able to readily replace these things. So that has posed a challenge in terms of the adoption of irrigation technologies widespread. Nonetheless, almost all our greenhouse farmers are adopting fertigation systems to facilitate production under a controlled environment.
- In terms of the climate, the social ecological environment and the productive factors and the processes that affect the sustainability of water and soil management, the most important issue there would be the topography and the connectivity issues, considering that Dominica is very mountainous, being one of the most mountainous islands in the Eastern Caribbean and, as such, those factors mentioned above has significantly limited the widespread adoption of irrigation systems.
- It's critical that every time there's a disaster, the county needs to import water. And, so for us, it is critical how we look at how we conceive and store water in terms of small equipment when we look at alternative resources in terms of low-cost irrigation. That is critical because we all suffer from droughts. In Dominica's case, there's not a defined and well-differentiated wet and dry season anymore, and so we also perform droughts.
- As recent as 2017, Dominica suffered significant impacts from Hurricane Maria, a tropical Category 5 hurricane, which significantly destroyed the GDP as well as the ecosystem based concerning agriculture.





International Projects



- Completion of the Agricultural Policy is ongoing, through support from the Food and Agricultural Organization (FAO). The existing voluntary guidelines (soil acidification, soil sealing, carbon sequestration, retention of soil organic matter) of FAO are the standing tenets which will be used as the basis for this work.
- The whole issue of retaining soil organic matter and carbon sequestration becomes critical, so the ministry is in Partnership with the World Bank through the Dominica Emergency Agricultural Livelihoods and Climate Resilience Project in promoting and accelerating the use of organic soil ameliorants as the preferred option with regards to soil fertility improvements. So, it has been making significant investments with regards to the financing and the procurement of alternative and or organic inputs that would become common practices across the landscapes in terms of farmer's practices.
- Dominica Water and Sewerage Company Limited (DOWASCO) is working on project to increase capacity/extent of buffer zones – this has been a challenge because of the hydrological patterns of Dominica.



- Several current projects include several international partners: The United Nations Environment Programme (UNEP), the UN Development Programme (UNDP), the Department for International Development (DFID, which was replaced by the Foreign, Commonwealth, and Development Office - FCDO), Canada Aid, Caribbean Biodiversity Fund, the GIZ from Germany, the Caribbean Development Bank, all looking at sustainable land management issues.
- There's a project funded by the Partnership Initiative on Sustainable Land Management (PISLM) in partnership with the GIZ and UNEP which looks at the sustainable land management and strengthening of the resilience of agricultural lands and forests in Dominica.
- There's a project under the UNDP that looks at the strengthening of the disaster risk capacity of women, more specifically at the dissemination of meteorological information



and how it can help farmers in terms of making more informed decisions regarding production planning and sequencing of crop production.

- Regarding demonstration units, officers are currently focusing on several systems to include micro-irrigation systems and rainwater technologies. They have recently benefited through partnerships with the UNDP, a program which they implemented in terms of a women farmers group that produce vegetables. The project supports the development of rainwater harvesting systems through the construction of rainwater catchment area and the provision of thousand-dollar gallon tanks that the farmers have then adopted in terms of the incorporation of drip systems onto their vegetable plots.
- Officers are also looking at fog harvesting system in some of the more hinterland areas where farming does take place, but water has limited availability. They are very problematic in terms of the ridges and the valleys that one has to access in terms of the source. We are contemplating fog harvesting technologies with some precision irrigation systems using aerial drone technologies. And that would be basically a very quick snapshot of the use of water and irrigation systems in Dominica.
- There is a dialogue with IICA in reference to the use of eco-based methods for slope stabilization such as using Vetiver/khus khus grass for slope stabilization. Slopes more than 30 degrees are predominant in Dominica.
- “Strengthening water and soil resource management for the sustainability of agro-food systems in Caribbean countries in the context of the COVID-19 pandemic” with German and Argentine Cooperation (2020-2023).

- Financing of procurements of organic inputs for farmer practice

- Retaining soil organic matter and carbon sequestration are being supported by the World Bank to promote and accelerate organic soil ameliorants.
- Working with Physical Planning Division for development of a Land Use Classification System, which will involve work on soil fertility maps. The existing soil fertility maps were developed in 1967 so there is need for this data to be updated; work is ongoing on this.
- The Ministry is concurrently working with the Physical Planning Division to review and upgrade the land classification system with attention to topography-based system (max permissible slopes) to guide decision making regarding land use.





Dominica needs for the sustainable management of water and soil resources.



SHORT TERM

- In terms of small-scale farmers, we need to look at small-scale and low-cost irrigation systems; also, it is important to stress that capacity strengthening is critical because some of agricultural actors are going through some transformation in their sector, where soil and water management is critical.
- In implementing soil conservation projects, one of the aspects would be looking at how we can strengthen national jurisdictions in terms of adopting voluntary guidelines for sustainable soil management.
- An investment needs to be made or even strengthen one of the labs capacities to do that and a human resource.

MEDIUM TERM

- Several of farms are near watersheds and/or water sources, reefs, streams and, as such, improving water legislative environment is becoming critical. So, the Water and Sewage Company is leading that cause with regards to strengthen the capacity of buffer zones, i.e., extending the radial coverage of these zones for increased buffers and water catchment protection. In consequence, improving water legislation is critical.
- It's important for the private sector to join in because most of the water authority is partly private and public and so a stakeholder approach is needed. But this recommendation is critical because, in Dominica, officers are interested in classifying lands. Some work has been done since the 1960s, so they need to move forward in terms of how map and identify the best land for agriculture. And they need to look at the land policy, critical for them because they are competing not only with tourism for infrastructure. All infrastructure development is competing with agricultural land. And if they are not careful and have the necessary policies, there will be no land for expanding or developing agriculture.
- The issue of soil and water conservation but focusing on hillside farming. The Organization of Eastern Caribbean States (OECS) countries have the same issues: landslide prevention and soil and water conservation, but as an economic venture as well. What do they do with the Vetiver? Do they do tree crops when they are doing soil conservation? So, recommendation is that they have to look at the soil conservation techniques and the species that they use, so farmers kind of economic gains from it.
- Building resilience to climate change and to ensure that we meet the full and efficient security of our countries.
- A more holistic approach is needed. Officers look at land classification and how to aid in existing work in the countries that are trying to classify and map the land and the fertility and nutrient distribution. They have to take that approach instead of looking at stakeholders because, in Dominica, most of the support comes from the public soil testing services. So, there is a need to take a more holistic approach when they look at land use policy, how do they have that mapping and classify lands into ecological zones, the right crop to plant in the different areas, and bringing the major stakeholders the effort of the IICA.



CHAPTER IV

GRENADA

CHAPTER IV - GRENADA



By Trevor Thompson and Celia Edwards

Government priority



- Sustainable agriculture, forestry, and fisheries production.
- Food and Nutrition Security.
- Climate Change resilience and disaster risk management.

“THE THREE GOVERNMENT PRIORITY AREAS REFLECT THE CARIBBEAN SITUATION AS WELL AS NATIONAL PRIORITIES AND PROPOSED OUTPUTS” (FAO, 2017).” (FAO, 2017).

State of local situation regarding recent natural disasters and Covid-19 Issues



NATURAL DISASTERS

- The hurricane risk in Grenada is the most significant. In 2004, Hurricane Ivan struck Grenada. Other events of consideration were Hurricane Janet (1955) and Hurricane Emily (2005) (World Bank Group, 2016).
- Hurricane Ivan was Grenada's most significant natural disaster, persons lost their lives and there was significant damage to economic and social structures estimated at almost 150 percent of GDP (IMF, 2022).
- Grenada was severely impacted by the 2009/2010 drought.

COVID-19 ISSUES

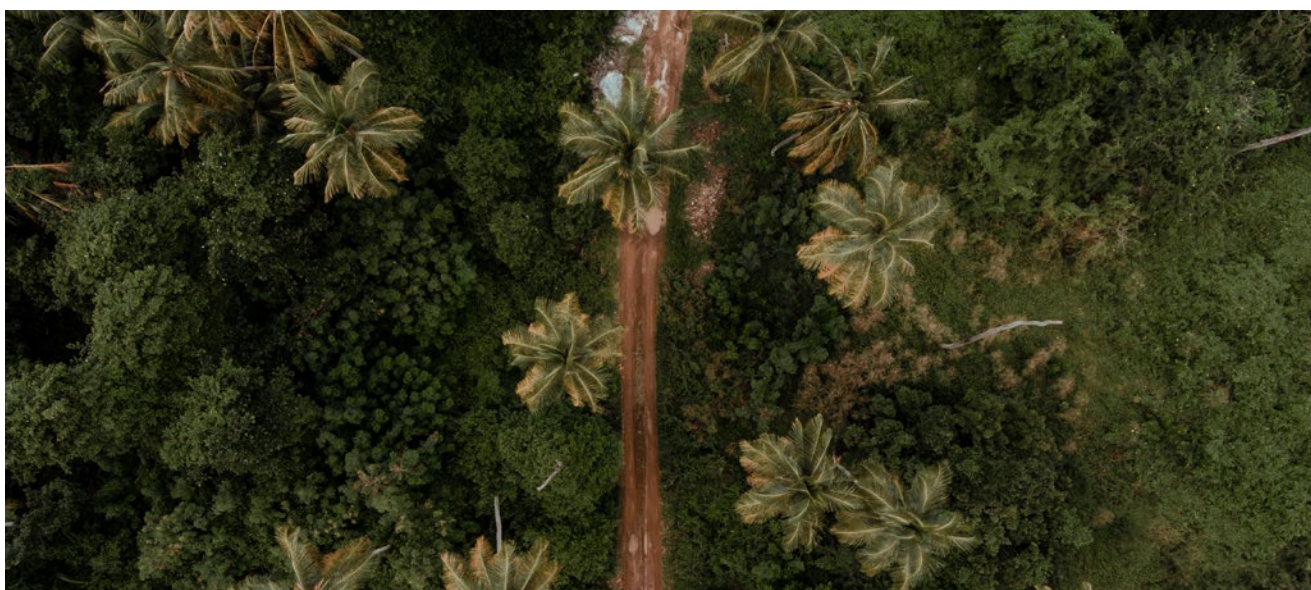


- There is the issue of pressures on agricultural lands that has been exacerbated with Covid-19. Due to the high unemployment rate during 2020-2021, there was a steady increase in the number of persons who returned to farming and or agri-business. However, with that comes a lot of challenges.
- Then with regards to the Covid-19 issues, Grenada developed a comprehensive agricultural food security plan to manage and combat the impacts of Covid-19 that was still in operation during 2021. The plan included the provision of support to farmers who needed to access their farms during lockdown. For example, special arrangements were made for farmers and people with livestock, etc. to get premise passes, tend to their animals or supply water to high-risk crops such as leafy vegetables.
- Then the issue of the social distancing, Grenada had to relocate its farmers market to reduce the spread of Covid-19 and that meant relocating farmers from where they normally would be. Social distancing: Farmers and vendors market were relocated to maintain social distancing, reduce the spread of Covid-19 while implementing other safety measures like



frequent hand sanitizing and washing, proper wearing of face masks.

- Grenada developed a food and nutrition security plan to combat the challenges that were faced over the past year and a half. Among these was the provision of special permission given to farmers so they could access their farms during the lockdown period.
- There was limited access to fresh healthy food during the lockdown. Also, the farmers' market was relocated to facilitate safe access to fresh fruits and vegetables in a space that permitted the implementation of social distancing protocols. Support was provided to farmers to help them expand acreage for food production. Many adjustments were made due to the fluidity with the Covid-19 situation and protocols; public education and awareness programmes were developed and strengthened to provide updated and relevant information to the farmers and other partners of the Ministry.



General island situation on the governance of soil and water



- Average rainfall per annum varies in Grenada. Inland, annual rainfall ranges from 3,750 - 5,000 mm, while in coastal areas it is between 990 - 1,500 mm. Work is ongoing to strengthen capacity for soil and water management in Grenada, Carriacou, and Petite Martinique through a multi-sectoral approach to water management.
- In terms of water management, water agencies and or authorities responsible for water information in Grenada are the Land Use Division of the MOA, the National Water and Sewerage Authority.
- In terms of infrastructure, science, technology and rural development, Grenada believes that the establishment of the water resources management unit will bring a transformation in the whole issue of how water is managed. Presently the water utility has all the legal rights over all water, and it means that there is very little management of the resource itself, so this unit will be responsible for the management of the resource and for issuing licenses, etc. to all who abstract water, including the National Water and Sewage Authority (NAWASA)



that is responsible for supply and distribution. And of course, as part of that, farmers will eventually have to pay for water abstraction for irrigation in a couple years' time once the unit is established and becomes operational.

- Grenada has also, with funding from UNEP, conducted a Technology Needs Assessment and this where there is focus on looking at adaptation and mitigation. It is interesting that as a small island state, Grenada realises that there is no clear distinction between adaptation and mitigation especially with water, where water is concerned, because every project that is done, there is research into how a mitigation component can be incorporated: there has been promotion, at the ministry level, of replacing fossil fuel generated power for example through the use of solar pumps for powering irrigation instead of fossil fuel.
- The Ministry is looking at modernisation of the agricultural sector; this is extremely important and will involve empowering human resources including extension officers and agronomists among others. By having more access to more real-time data and information, once they out in the field, the officers will be able to help and advice farmers almost instantly, whether it be related to pests and disease or advise on the temperature trends and how much water is needed for irrigation efficiency for example. It is believed that this is what is really needed for this era. Also, the use of drone technology to help with land use planning and expansion of acreages under irrigation, increasing the use of protective structures and of course, using renewable energy and promoting the use of Vetiver Grass as a soil conservation measure are aspects earmarked for incorporation in the national agricultural practices.
- Grenada is advancing towards gender sensitive water resources management and working to strengthen our capacity for soil and water management in Grenada, Carriacou, and Petite Martinique.
- In Grenada, the ministry started the multidisciplinary approach to extension services. Water, agronomy, and land use issues are assessed and addressed on various timelines as requested. Some issues are handled daily, other weekly and or quarterly. There is a good working relationship between the Extension, Land Use, Agronomy, and the water authorities. Extension reports weekly, monthly, and quarterly through the ministry's head office. Urgent reports are handled promptly. However, there is a need for more training opportunities and resources required to carry out their day-to-day operations for prompt and efficient service delivery throughout the year.
- There is limited capacity to monitor some of the activities that they are required to carry out. This is because of a small number of staff that is involved in most of the processes due to attrition. Several persons have since retired from the service and this has created some negative impacts on goods and services delivery within the sector.



National and/or regional strategic policies or plans for the governance of natural resources



Sustainability of natural (land) resources:

- The National Agricultural Plan 2015-2030, National Climate Change Policy, National Drought Policy and Management Plan, National Adaptation Plan, National Determined Contributions, National Sustainable Development Plan 2020-2035, National Biodiversity Strategy, National Coastal Zone Management Plan and Local Area Plans are used for strategic planning. These contain specific reference to Agriculture and water resources development and management.

There are also several plans used for strategic planning:

- National Agricultural Plan 2015-2030
- Draft National Drought Policy and Management Plan that was funded by the United Nations Convention to Combat Desertification (UNCCD) during 2019
- National Sustainable Development Plan 2020-2035 which is the document for a lot of our planning that has within it a component on agriculture.
- National Biodiversity Strategy and Action Plan.
- National Coastal Zone Management Plan and Local Area Plans.
- We have several Ridge to Reef Watershed Management Plans that were developed under the UNDP Ridge to Reef Project in 2015.
- National Climate Change Policy and National Climate Change Adaptation Plan (NAP) 2017-2021.

Other key national plans:

- Grenada National Land Policy (2021).
- Providing for Sustainable Land Management and Ecosystem Resilience.
- Grenada National Climate Change Policy (2017-2021).
- Grenada National Adaption Plan (2017-2022).
- Grenada National Agricultural Plan (2015).
- Grenada Nationally Determined Contributions (2020).
- Annex II-E Grenada Country Analysis Report (October 2016).
- Final Draft Technology Needs Assessment Report (Adaptation), 2016.

Soil management:

- Grenada Land Degradation Neutrality Report, 2015

Water management:

- With respect to Grenada's context from sustainable water and soil management perspective, there are several national plans. Grenada's National Water Policy (2020) and Grenada's Integrated Water Resources Management Plan (IWRM Plan 2019) were approved by Cabinet in 2020.
- National Water Policy of 2019: Authorities and stakeholders are in the process of updating the other three documents: The Water Resources Management and Regulation Bill, the



National Water and Sewage Authority Amendment Bill, and the Public Utilities Regulatory Commission Amendment Bill.

- Integrated Water Resources Management (IWRM) Communication Strategy and Implementation Plan 2021.
- Grenada Drought Management Plan (2019).
- Grenada is presently working on the draft legislation that will give effect to the Water Policy. The draft legislation has provisions for the establishment of a Water Resources Management Unit (WRMU) which would be responsible for the management of the water resources in Grenada. The island is taking an integrated approach to managing water resources, for which there is a Cabinet Approved National Land Policy with Draft Land Management Act which is soon to go before Cabinet.
- Plans are in progress to support the establishment of a Water Resources Management Unit, scheduled for the second or third quarter of 2023. The regulatory organization to oversee this unit would be the Public Utilities Regulatory Commission (PURC).
- Regarding the regional policies and plans and strategies that Grenada is part of, the island is part of the Global Water Partnership Caribbean Integrated Water Resources Management Plans for the entire Caribbean countries that has been developed now with support from the OECS Secretariat. Grenada is also supporting the Regional Strategic Action Plan for Building Governance and Resilience in the Water Sector (RSAP), a collaboration between GWP-C, the Caribbean Water and Wastewater Association and the IDB, CARICOM, IICA and CARDI, among others; several regional organizations that are collaborating on how they could really build resilience and improve on the governance structure in the water sector.
- And of course, Grenada is in full support of working towards achieving SDG 6. It has completed the report on SDG 6 which is dealing with water security and, of course, is part of the Cartagena Convention and the Land-Based Sources of Pollution (LBS) Protocol for the Caribbean where Grenada looks into addressing the issues of land-based sources of pollution affecting Grenada and the Caribbean Sea. The Protocol concerning pollution from Land-Based Sources and Activities (LBS Protocol), which was adopted in 1999 and entered into force in 2010, is one of three Protocols of the Cartagena Convention. This legal instrument consists of obligations to reduce the negative environmental and human health impacts of land-based pollution in the Wider Caribbean Region (WCR).
- The Grenada Meteorological Service recently prepared a National Strategic Plan and Framework for Weather, Water, and Climate services with a complementary action plan.
- Other instruments that address water use and management: officers are looking at the WHO Water Quality Guidelines, Standards and Health. It is important to refer to the United Nations Department of Economic and Social Affairs. These organizations have been providing information/technical guides and support with analysis and capacity building.
- Some programs that we have been very involved in would include the SDG 6, the IWRM support program and this is still ongoing. SDG target 6.5 is: 'By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.'
- To track progress towards the target, indicator 6.5.1 monitors the degree of integrated water resources management (IWRM) implementation, by assessing the four key dimensions of IWRM: enabling environment, institutions and participation, management instruments and financing with the following score ranking: Very low (0-10) – Low (11-30) – Medium-Low (31-



50) – Medium-high (51-70) – High (71-90) – Very high (91-100). Grenada conducted several assessments to gather information on gender inclusion in water resources management, and to assess the degree of implementation of Integrated Water Resources Management. The figures collected from the Country Instrument Surveys during 2017 showed a low score of 25%. During 2020, the score was medium to low, with a figure of 31% while the global average was 54%.

Governmental information



Governmental agencies or companies that are responsible of gathering information about soils and assessing the land:

- The Grenada Meteorological Service is based at the Maurice Bishop International Airport (MBIA), and the National Water Information System (GNWIS) which is housed at the Land Use Division/Irrigation Management Unit within the Ministry of Agriculture and Lands, Fisheries and Cooperatives that is the National Repository for all land, water, and climate data.
- The Grenada Meteorological Services provides several climate data, products, and services with support from the CIMH. The Ministry collaborates with and receives support from various organizations.
- Other key Divisions that provide support include Agronomy, Extension, and Planning Division.
- Institutions responsible for collecting and analysing water quality and hydrology: Main institutions include the National Water and Sewerage Authority (NAWASA), Produce Chemist lab, The Land Use Division/Irrigation Management Unit, and the Grenada Bureau of Standards. The Water Resources Management Unit will have some responsibility for collecting and analysing data on water as well as IWRM.
- Water is one of the most important natural resources of the country. Grenada was severely impacted by the 2009/2010 drought, which led to the Land Use Division of the Ministry of Agriculture working closely with NAWASA and Met Services to strengthen the collaboration to enhance capacity building efforts for drought early warning information system with the kind support of the Caribbean Institute of Meteorology and Hydrology and other partners.
- Some of the key organizations involved in soil management include Land Use, Agronomy, Extension Divisions within the Ministry of Agriculture, Lands and Forestry. The Ministry also relies on support from Marketing and National Importing Board who do some soil testing with support within the region. Unfortunately, that service has been on hold due to the Covid-19 pandemic. It also relies on information on conventional cartography, digital/satellite imagery, and LiDAR mapping.
- In terms of institutions responsible for collecting and analysing social aspects for water planning and management, institutions include Ministry of Agriculture and Lands and Fisheries and Cooperatives with support from the Ministry of Social Development. The National Agricultural Census is scheduled for 2023. The Ministry of Social Development conducted several assessments that would highlight some of the social aspects and issues relating to water planning and management.



- The Land Use Division receives unwavering support from the Global Water Partnership Caribbean and officers are very grateful for that support. The Water Resources Management Unit will also have some responsibilities to implement several roles and functions on water management.
- Other institutions responsible for collecting and analysing social aspects for water planning and management also include the Grenada Central Statistical Office. Grenada is in the process of conducting the National Housing and Population Census this year. Data relating to water at the household and community levels will be collected.
- The digital platforms databases that are managed by the Land Use Division: The Hydromet Network, National Water Information System (Online) and Grenada Land Information System (National GIS Database which is in-house), LiDAR Database (In-house). Several supports are provided to our clients; farmers, researchers, and students as it relates to data on rainfall, water resources, and weather and climate information with support from the Meteorological Service and the CIMH (The Caribbean Climate Outlook Forum (CariCOF) monthly bulletin, CariSAM Bulletin, Caribbean Drought Bulletin).
- In terms of SDG accountability in Grenada, officers monitor the degree of IWRM implementation of indicator SDG 6.5.1. They conduct a number of consultations with key stakeholders to gather information, different knowledge, attitudes and practices as it relates to the indicator.
- Officers also share data with our stakeholders. We share data from the Ministry of Agriculture - Land Use Division/Irrigation Management Unit on rainfall, temperatures, and other parameters. They work closely with the Meteorological Service, NAWASA and NADMA to ensure that the information that they provide is in the language that is easily understood by the different stakeholders.

Water agencies or authorities:

- Grenada was preparing to establish the Water Resource Management Unit during 2021. When Covid-19 impacted the agri-food sector, the focus was on strengthening our food security plan in that regard. Therefore, plans are underway for the establishment of the WRM Unit between 2022 and 2023.

Key weaknesses:

- Firstly, lack of sufficient capacity and resources to conduct research. Within the last ten (10) years, several persons have retired so there are less staff within the ministry and key divisions due to attrition.
- Limited access to financial resources coupled with the high inputs and operational costs for implementing some of the technologies that we would have mentioned previously.
- There is also the challenge of limited analytical capacity of data on water resources. The WRM Unit Will also have responsibility for data management on water and other natural resources.
- Limited access to conduct soil and water quality analysis. The lack of a soil laboratory compounds some of the issues that are mentioned above.
- The Ministry receives strong support from the National Water and Sewerage Authority. Several key stakeholders are collaborating on the establishment of the Water Resources Management Unit tasked with the integrated management of water resources in Grenada.
- Other platforms include the Climate Finance Portal for Grenada with information on the various



plans and programs or policies that exist as it relates to climate change, water, soils, and other key programs that the Ministry and its partners are involved in.

Moving on to the main problems and constraints:

- Limited human resources due to attrition.
- Training to increase the knowledge, attitude, and practices of IWRM, Climate Smart Agriculture, Sustainable Land Management, and Integrated Land Management.
- Financing is also a challenge.
- Fragmented data and the COVID-19 pandemic hindered implementation of key programmes during 2020-2021.
- Extension Officers and Assistants work with individual farmers, farmers' organisations or groups, and agriculture-focused projects. They also conduct individual site visits and or visit with a team when necessary. The team include personnel from Agronomy, Land Use, Pest Management, Livestock Division, Extension. Through this multi-disciplinary approach, the team can tackle the various issues that may exist on each farm or each farming group.

Water and Soil analysis:

- Grenada does not have a soil laboratory in 2021. There was one in the past, but it was destroyed by hurricane Ivan and its reestablishment was not a high priority issue for the government in comparison to the rebuilding homes and families. One of the resources that the government really needs is a soil lab to help with soil management.
- Soil management problems and barriers include a lack of sufficient capacity to conduct research, high inputs, and operational costs, of course, lack of soil analysis laboratory. There is also fragmented data on soil and water resources.
- Despite the expansion of farms, the lack of a soil laboratory means that there is limited soil analysis; this results in over reliance and incorrect use of fertilisers. Comprehensive soil surveys are also lacking; the last soil survey was conducted during 1954, approximately 67 years prior. There is therefore high dependence on regional and international laboratories; this is costly and unsustainable due to challenges imposed by the COVID-19 pandemic. Efficient irrigation, water and land use management are critical aspects necessary and that would be for a successful agricultural sector in Grenada.
- Grenada's small soil lab was established in the 1980s but was destroyed during the passage of Hurricane Ivan in 2004. It was possible to recover some of the equipment; Some of the recovered equipment is temporarily housed in the Produce Chemist Laboratory pending installation of an official Soils Laboratory, but use is limited and further there is no staff with skills in soil science at the ministry.

Soil conservation practices of the producers

- And then, of course, the public awareness is critical in advocating for climate-smart agricultural practices and Grenada is working with a lot of farmers to get them to implement proper agricultural practices. Public Education and Awareness Programmes are promoted and shared via various media platform by the PR Unit of the Ministry and staff, GIS, and other organizations.
- Most of our farmers, traditionally plant what they plant, they don't really change much. Those



that are vegetable farmers they do generally the same type of farming, the same general crops. And so, they don't usually have any soil fertility tests or anything like that conducted prior to them starting, which is something that is important in terms of how they would in the whole soil nutrition and how they would, what they would get from the production simply due to what the soil has it.

- They continue to remove the nutrients from the soil and many of the times it is not replaced in any kind of systematic manner. We're trying now to get them to really get into crop rotation and the different types of crops that should be planted after each other. You know, the succession of the crops to assist them with getting some of the nutrients back and getting back that balance to the soil. But because a lot of them don't understand what it is you're doing, they don't really, they haven't, many of them have not taken up that practice. We also have the situation where they over fertilize. So as soon as they stop getting the amount of production that they would usually have gotten or would have gotten the year before, then they would just start putting a mixture and they're not sure what it is they're putting, sometime they're not sure of the amounts that they're putting and a lot of the times they're knocking out the balance in the soil, so you have so much of the macronutrients and not enough of the micros that you end up with an imbalance that the plants can't take it up anyway.
- So those are the situations that we're faced with. So, in terms of the nutrition that is done, those are some of the situations that agricultural officers were faced with. The other major parts of the agriculture sector in Grenada are the traditional crops, which is tree crops. They plant those integrated with other crops so that they get some of the fertilization from that. And now soursop has come out as a very important tree crop also. They don't usually think of trees as having to be fertilized. And the whole soil nutrition and all of that is not really taken as something that need to be fertilized. They think that the short crops, the vegetables, and those need fertilizer. But the big trees, it is believed that they could sort out on their own. So that is a general situation.
- Pilot Agricultural Land Bank Project: The ministry has two pilot sites under that project. On one of the pilot sites, most of the lands are quite steep and officers are looking to bring in new people into that area to start farming. The farmlands in there have been sitting idly by or abandoned for quite a while. There are some unregularized occupants there farming on some of those lands. Most of the lands on the other pilot site under that project more or less are virgin and the terrain there is steep in some areas. For new people that technical teams are looking to bring in there to begin farming, practicing sustainable management practices would be critical, for example, terracing and so on like that. So, It is needed any support in that regard, in terms of capacity building in soil conservation and in terracing or contour farming and so on.





Practices on collective and/or individual water management that farmers and water agencies carry out:

- Regarding existing demonstration plots, there are three main propagation stations located at Mirabeau, St. Andrew, Maran, Saint John, Ashenden, Saint David. The Agronomy, Extension and Land Use Divisions frequently conducts training in key areas on irrigation, sustainable crop management practices and CSA techniques. Some of the propagation stations are in dire need of rehabilitation.
- There are some farmers organizations. It's something that we're really working on trying to get the farmers to form these associations and these groups. There are few functioning ones. There are lots that have been formed. But the functioning ones, there are few of those. And the few functioning ones, they do function well. It is something that we're really trying to encourage our farmers to get into doing.
- The collective has already been mentioned. Individually, there are various standards for water analysis. The Produce Chemist Laboratory also provides support to individual farmers and consultancy for different projects on water quality testing and other services to businesses.
- In terms of the demonstration plots, training activities are conducted by the Ministry of Agriculture. The Ministry is involved in farmer field school type trainings. There are needs with regards to resources for strengthening our farmer field school practices and training to strengthen capacity to conduct activities such as mapping of irrigation sites and water resources in Grenada. We are also in the process of mapping our soil fertility, through collaboration with local, regional, and international bodies.

Problems/constrains for productive soil management:

- The issue of land tenancy which is an issue because of the current economic situation, the pressure on agricultural lands which is linked to changing land use structures from agricultural to other uses such as residential areas. People need money, so they are selling lands to improve their livelihoods. That is an issue that has to be addressed to ensure there is sufficient land for agriculture.
- Grenada has a recurring problem because of its terrain; less than ten percent of our land is flat. Whenever there are heavy rains or a storm, the farmers have limited access to their farms which is a challenge.
- Impacts include pressures on agricultural land, changing land use, weather and climate incidents, limited access to farms caused by storms, floods and other hydroclimatic disasters. There has also been severe crop damage during seasonal and unseasonal rainfall and new and emerging pests and diseases affecting tree crops and vegetables such as citrus greening, scale insects.

Problems/constrains for water management:

- Another challenge is that of limited integrated water resources management implementation.
- Grenada has observed, because of climate change, seasonal changes in terms of rainfall. So sometimes the dry season is wet, and the rainy season is dry, and this is having an impact on agricultural production and, of course, some new and emerging pests and diseases that are affecting crop and this is one area that really needs attention under this project: the whole



issue of addressing new and emerging pests and diseases that are affecting tree crops and vegetables.

- Climatic factors such as those mentioned previously: increases in atmospheric and sea temperatures, decreases in the quantity and frequency of precipitation during the rainy season. We have also experienced changes in weather and climate which have impacted the water sector, the food and nutrition security including other key sectors such as tourism and construction.
- Grenada's water resources comprise primarily surface water with an estimated groundwater potential to satisfy about 10% to 15% of the present potable requirement as stated in the Water Supply Expansion and Sewerage Improvement Project (2016). The smaller islands Carriacou and Petite Martinique: domestic water is derived exclusively from rainwater catchments. We have noticed several changing land use patterns, increasing population in various areas, expansion in tourism and future implementation of proposed irrigation schemes that would also impact our water management, water availability and so on.
- The social factors: Water scarcity is a tough one. Decreases in crop production and yields which would impact food availability and security. Traditionally, there is limited women participation in water resources management, but currently women are becoming more involved with other key stakeholders at various levels to ensure that we work on mainstreaming gender and practices in Water Resources Management.
- Change in land use patterns, changing livelihoods options, and increases in water consumption due to unsustainable management and practices that is negatively impacting our people, our economy, and our environment. Hence, technical institutions are working to resolve these issues.
- There are seasonal variations in supply. The increased demands over time have heightened levels of awareness of watersheds. Following public education and awareness programmes, and public consultations, people are more informed about the issues and how they can solve some of these issues in coordination with authorities.
- Other processes that affect the sustainable use of water include, but are not limited to, limited access to farms caused by storms, floods, and other hydroclimatic disasters which impacts land and water, including residential and business communities.





International Projects



- In terms of ongoing projects, there is the Climate-Smart Agriculture and Rural Enterprise Program (SAEP) that is focused on rural and livelihood development with a focus on youth and irrigation infrastructure development, access to financial resources, and capacity building for Agriculture Extension staff with a focus on increasing resilience in the agricultural sector and Climate-Smart Agriculture (CSA). SAEP, is a six-year programme (2018- 2024) funded by the International Fund for Agriculture Development (IFAD), Caribbean Development Bank (CDB) and the Government of Grenada.
- Also, there is the UNDP-funded Climate-Resilient Agriculture for Integrated Landscape Management Project which addresses land and soil degradation. UNDP GEF 6 Climate Resilient Agriculture for Integrated Landscape Management Project (UNDP/GEF/CRA Project).
- The GCF-funded Climate-Resilient Water Sector in Grenada (G-CREWS) Project has an initiative called the Challenge Fund for Agriculture (CFA) which is providing support to farmers to install rainwater harvesting systems and water-efficient irrigation systems (drip and micro sprinkler irrigation), rainwater harvesting, shade houses, and hydroponics.
- Climate-Resilient Water Sector in Grenada (G-CREWS) Project -Challenge Fund for Agriculture.
- CFA, funded by the Green Climate Fund (GCF), German Agency for International Cooperation GmbH (GIZ), International Climate Initiative (IKI) and the Government of Grenada.
- The Challenge Fund for Agriculture (CFA) is being implemented by the Grenada Development Bank (GDB) in collaboration with the Ministry of Agriculture and Lands, Fisheries and Cooperatives. Eligible farmers will receive a reimbursement grant of 100% of the equipment for one or more of the water efficient technologies: drip/micro sprinkler irrigation, shade houses, rainwater harvesting and hydroponics.
- An FAO and Government of Grenada funded Pilot Agricultural Land Bank Project, that is providing lands to landless farmers, women, and youth. To support this pilot project, the government has provided lands from two government estates to the project as demonstration sites to encourage private landowners to put their land into the Land Bank that can then be leased to individuals who are interested in farming but have no access to lands.
- The Pilot Agricultural Land Bank Project is a collaborative initiative between the Ministry of Agriculture and Lands, Fisheries and Cooperatives (MOALFC) and the Food and Agriculture Organization (FAO), which was officially launched in July 2017.
- There's also the CSIDS's SOILCARE Phase 1 (Caribbean Small Island Developing States Multicounty Soil Management Initiative for Integrated Landscape Restoration and Climate Resilient Food Systems) that's funded by the GEF, with FAO as the Executing Agency and PISLM as the Implementing Agency.
- The MoALFC is supporting the implementation of the Caribbean Small Island Developing States (CSIDS) Multicounty Soil Management Initiative for Integrated Landscape Restoration and Sustainable Food Systems: (CSIDS SOILCARE Phase 1) Project.
- FAO and the United Nations Convention to Combat Desertification (UNCCD) facilitates cooperation between developed and developing countries, particularly around knowledge and technology transfer for sustainable land management to meet the Sustainable Development Goal to achieve Land Degradation Neutrality (LDN).
- In Grenada, the project will seek to address ongoing land and soil degradation and deforestation through the sustainable management of productive landscapes in Les Avocat, St. David;



Ludbur, St. Andrew; Chambord/Rose Hill, St. Patrick; and Carriacou (the sister isle).

- Grenada is also in the process of finalizing the testing of a completely new hydrometric/agrometeorological network that is focused on collecting climate data for agriculture and water services in Grenada. Approximately thirty (30) hydromet/agromet stations have been installed at strategic locations across the country.
- In 2023, Grenada will begin implementing the national component of the Integrated Landscape Approaches and Investments in Sustainable Land Management in the OECS Project (OECS ILM Project). This project will, through the input or participation of multiple stakeholders, set out to, among other things, rehabilitate the nutmeg and cocoa fields, cultivate root and tuber crops and vegetables, and implement sustainable land and soil management practices and biodiversity conservation measures on one of two proposed project sites (Grand Bras Estate or Grand Bacolet Estate).



- Grenada is implementing the national component of the Integrated Landscape Approaches and Investments in Sustainable Land Management in the OECS Project (OECS ILM Project): Restoration of Abandoned or Underutilized Croplands in Grenada through the Implementation of ILM, SLM, and Climate-Smart Agricultural Practices.
- Grenada is participating in the GEF-funded IWeco Project and the FAO-funded regional project that's looking at protected agriculture. The Innovative Protected Cultivation Systems Project is focused on capacity building for shade house and greenhouse management, operation, maintenance, etcetera. Training on the demonstration farms would build farmers capacity in how to efficiently use the shade houses, greenhouses, etc.
- The Ministry is supporting "The Integrating Water, Land and Ecosystems Management in Caribbean Small Island Developing States (IWeco Project) - is a five-year GEF-funded project which addresses water, land and biodiversity resource management as well as climate change in ten (10) Caribbean Small Island Developing States.
- Survey completed to supplement IWeco Component 3, during June 2021; to Strengthen Policy, Legislative and Institutional Capacity to Support Sustainable Land Management and Water Resources and Ecosystems Management in IWeco Participating States.
- Grenada presently has several staff participating in the UN Food and Agriculture Organization Protected Agriculture Project and the Pilot Programme for Climate Resilience (PPCR Project) and CARDI's Climate-Smart Agriculture Webinar Series, where they provide a lot of training on climate-smart agriculture and agrometeorology to officers of the Ministry.
- There is also a Young Entrepreneurs, Farmers and Fishers in Agriculture and Agribusiness



Project (Youth in Agriculture Project), funded by the CARICOM Development Fund (CDF), that will be focusing on seeking to get more youth into agriculture.

- The island is also part of the Morocco Soil Fertility Mapping Project. The project was implemented in the Windward Islands between 2015-2019. Implementation includes developing a soil fertility map for the total cultivated area of Grenada. The project completed the field sampling and over 700 soil samples were sent to the Kingdom of Morocco for testing during 2019. The Ministry of Agriculture and Lands, Forestry and Fisheries received equipment for establishing a soil database.
- Grenada has just concluded a GEF Small Grants Programme (SGP) Vetiver Grass Cultivation Project, and it is believed that Vetiver Grass has great potential for soil erosion management on the island and the technical officers hope to do a lot more propagating of it to expand cultivation.



- In 2000 and the last two years, the Ministry was working on a pilot program for a climate resilience project hoping to execute a comprehensive soil survey of Grenada. However, this was not possible due to inadequacy of funding. The Terms of Reference for this Soil Survey of the entire island was developed and is available for consideration. It would examine, inter alia, different properties of soil, including the engineering aspect. Over the past two years, major damage has been experienced to the western road artery because of soil/land subsidence. This emphasises the importance of the soil survey which would inform decision-making based on the suitability of islands for various interventions.
- The G-CREWS Challenge Fund for Agriculture (CFA) is a new project that is ongoing. The CFA is providing grant funding for irrigation support (that include drip irrigation, micro-sprinkler), shade houses, hydroponics, and rainwater harvesting.
- Ministry officers have been involved in a multi-disciplinary approach in the provision of extension services, that has been ongoing for the last couple of years to provide support to the farmers, determine their training needs and to find out what other resources are required to accomplish their goals on farm and in business. However, this approach has been seriously impacted by attrition, Covid-19, and other factors.



- Some of the productive factors and projects that contribute to the sustainable use of water in Grenada: The Grenada Meteorological Services, The G-CREWS Project, FAO Innovative Protective Cultivation Systems in the Caribbean, The Caribbean Regional PPCR/CARDI Climate Smart Agriculture Project, and the others as listed previously.
- “Strengthening water and soil resource management for the sustainability of agro-food systems in Caribbean countries in the context of the COVID-19 pandemic” with German and Argentine Cooperation (2020-2023).





Grenada needs for the sustainable management of water and soil resources.



SHORT TERM

- On a small island and with a very small population of approximately 110,000, the capacity to implement new technologies/innovative ideas is tied to a limited human resource, but one of the big challenges we have is the high cost of inputs.
- Main policies and programmes for transforming the productive sectors such as Tourism and Agriculture.
- Strengthen agriculture to increase food production thereby reducing the food import bill and enhancing food and nutrition security.
- Develop agri-processing industries to increase value added in the economy, strengthen linkages within the agriculture sector and reduce unemployment, particularly in the rural areas.
- Develop the creative industries to diversify the economy, and reduce unemployment, particularly among the youths.
- Strengthen the use of ICT to improve the delivery of government services, enhance agricultural production and outputs, improve the efficiency of revenue collection, and develop ICT models that could be adopted by the private sector, thereby preparing the population to operate in the digital economy.
- Develop a tourism industry that is well integrated with the other economic sectors and blends with the natural resources.
- Grenada would need support with equipment and technical capacities to support its agri-food systems. It would also need support with infrastructure, science, new technologies, community-supported agriculture and increasing awareness for the implementation of soil and water management projects.
- Some of the key strengths and key weaknesses: The implementation of sustainable agricultural practices. It's one of the areas that officers are grateful for. They're working to promote and improve these to ensure good implementation in various programs and projects throughout Grenada. In terms of planning for sustainable database management on soil, water, and other resources, this is a priority. Climate-Smart agriculture initiatives as those mentioned previously, and officers are also involved in strengthening infrastructure, the science and technology and rural development, ICT innovation in agriculture. There is a keen interest and focus on drone technology, which is new to Grenada.
- Farmer-field school that was something that ministry boasted of in the past. Officers need to implement FFS Programs and tackle some issues through training on soil sampling, fertilizer use and handling and the provision of tools for staff and farmers. In terms of training, officers are looking at also GIS mapping, LiDAR and other suitable areas to achieve the objectives of this project.
- Ministry officers are looking forward to greater collaboration with INTA, FAO, the Global Soil Partnership, Global Water Partnership, and other key organizations to develop suitable programs for sustainable soil and water management.
- The Ministry promotes sustainable agricultural practices. These include new direction and sustainable management, integrated landscape approaches and management in Grenada. Several projects will be focused on implementing key measure on soil and water management.



- The Ministry also has sustainable databases on soil and water, and other resources for sustainable water and soil management, such as sustainable land use planning and practices, and we also think a good repository and dedicated staffing is necessary.
- Work commenced on a soil fertility map in partnership with Morocco but is still ongoing. For agricultural purposes, the islands need a map showing the soil properties: holding capacities and other information that is useful for agronomy, and irrigation and infrastructural development such as construction of roads, bridges, and institutions such as hospitals, schools, recreation grounds. Grenada is not a very flat island; less than 10% of the island is flat land, thus the common solution for executing projects on the land involves excavation and cutting. Soil structure and soil properties are extremely important to make the right recommendations to government and even the private sector. The benefits of these could spill over into insurance coverages and provisions to recover from storms and hurricanes and flooding, all of which are linked to soil characteristics and water management.

MEDIUM TERM

- Considering the Water Resources Management Unit that is scheduled to be established later this year (2021), Grenada is also hoping for some support in terms of research and assessments that will be ongoing, which is a key role of the water resource management unit. The Ministry acknowledges that to break some of these existing barriers mentioned earlier it is necessary to increase its capacity to conduct research and train staff, especially Land Use, Agronomy and Extension Divisions, in the skills needed to support ongoing projects. The Ministry would like to focus on some climate change adaptation and mitigation strategies.
- The Ministry acknowledged the need for more access to resources and training in agrometeorology, irrigation and GIS. It needs suitable equipment for climate monitoring for the agriculture sector, a soil laboratory, support with soil sampling, testing and analysis and skill building to support the ongoing soil fertility project, under which the Ministry is in the process of enhancing productive use and rehabilitation of agricultural lands and working towards improving water resources management. Another weakness that needs to be addressed is use of technology such as protected structures for growing suitable crop varieties.
- Work is ongoing to strengthen capacity for soil and water management in Grenada: the island looks forward to receiving additional support to execute its initiatives to accelerate the achievement of the SDG indicators related to soil and water management. There are opportunities for increased capacities for multi-scale land use planning and implementation.



CHAPTER V

SAINT LUCIA



CHAPTER V - SAINT LUCIA

By Eloi Alexis and Miguel Montoute

Government priority

- Access to land, food, and decent employment.
- Natural resource management, disaster mitigation and resilience.
- Improve the performance of the agricultural sub-sectors.

“THE THREE GOVERNMENT PRIORITY AREAS TAKE INTO CONSIDERATION SAINT LUCIA’S COMMITMENTS AS A MEMBER OF THE ECONOMIC UNION UNDER THE ORGANIZATION OF EASTERN CARIBBEAN STATES (OECS), THE UN DEVELOPMENT ASSISTANCE FRAMEWORK FOR BARBADOS AND OECS, THE OECS TREATY ON AGRICULTURE AND THE ST GEORGE’S DECLARATION ON ENVIRONMENTAL SUSTAINABILITY IN THE SUBREGION.” (FAO, 2017).

State of local situation regarding recent natural disasters and Covid-19 Issues

NATURAL DISASTERS

- Hurricanes and tropical storms.
- Problems with Standard Precipitation Index: disruption/reduction in terms of period in the volume of rain, rainfall pattern has changed.
- High evapotranspiration rate attributed to climate change.

COVID-19 ISSUES

- Reduced purchase of local produce by the hotel sector (due to low visitor arrivals/closure of hotels).
- Consumer spending power has been reduced.
- Local or regional protocols or manuals of Good Agricultural Practices due to COVID pandemic: available but not used.



General island situation on the governance of soil and water



Territorial order

- The Government through Forestry Department has several forest reserves and mangroves which are protected from farming and other developments such as tourism. However, National Land Use Policy is (in draft form – July 2023).
- List of Forest Reserves.
- Edmund Forest.
- Grand Maragarzinee (Saltibus).
- Debottles reserve.
- Mangroves (mangroves are estimated in 2005, 200 hectares).
- Ma Kote, mangrove which is the largest.

National policies or plans for the governance of natural resources.

Sustainability of natural (land) resources:

- National Land Use Policy (draft).
- Physical Planning Act.
- National Adaptation Plan.
- Sectoral Adaptation Strategy Action Plan (fisheries, agriculture, water focussed, tourism) (2018 – 2028).
- Environmental Health Act.
- Disaster Risk Mitigation Plans.
- Environmental Management Bill (draft).
- Environmental Impact Assessment Regulations (draft).

Soil management:

- Forest and Land Resources Strategy (2015 – 2025).
- Agriculture Policy Framework and Strategy (2016– 2021) (being updated by the Food and Agriculture Organization of the United Nations).

Water management:

- National Water Policy/Water Policy Update for Saint Lucia (2004: Currently being updated).
- Water and Sewerage Act (CAP 9.03, 2008).
- Water and Sewerage Regulations.
- Watershed Management Plans (Castries and Vieux Fort) (final draft).
- Wastewater Management Strategy and Action Plan (final draft).



Regional Strategic Partners



- Caribbean Institute for Meteorology and Hydrology – liaison – provide benefits with Caribbean countries re meteorology and standardizing equipment, e.g., procuring resources from brand and standardizing across the region; provide technical experts to assist the islands; equipment provided, and online; CIMH has access to the data gathered and this is also shared with the partners.
- CARPHA – Water Quality Monitoring.

Regional Educational Institutions for training in Water and Soil Analysis



- University of the West Indies / Centre for Resource Management and Environmental Studies (CERMES): promotes and facilitates sustainable development in the Caribbean and beyond.





Governmental information



Governmental agencies or companies that are responsible of gathering information about soils and assessing the land:

- Agricultural and Engineering Services Division of Ministry of Agriculture.
- Forestry and Land Resources Division.
- Physical Planning Unit.

Water agencies or authorities:

- Water Resource Management Agency (WRMA).
 - Use of surface and ground water for domestic, industrial, and agricultural purposes.
- National Utilities Regulatory Commission.
- Environmental Health within the Ministry of Health.
 - Regulating wastewater effluents (multisectoral).
 - Enforcement powers.
 - Work closely with Physical Planning Department for approval developments.
- Drainage and Irrigation Unit within the Agricultural and Engineering Services Division of Ministry of Agriculture. Assist with the following matters:
 - Designing of irrigation systems and installation of the same (preferably drip irrigation).
 - Designing and orientation of drainage systems.
 - Issuing of early warning systems of drought conditions.
- St. Lucia Meteorological Office.
- Caribbean Public Health Agency (CARPHA).
- Department of Fisheries.

Natural area or infrastructure being used for water management.

- Rainwater harvesting.
- Groundwater infrastructure has been installed by the private sector such as hotels and some industries to determine the viability of the soils.
- In the Soufriere Watershed groundwater from free-flowing springs is used by the water utility for supply residents.





Soil Analysis Laboratories:



- The National Diagnostic Facility was formerly opened in 2020, which houses several units.
- Research and development.
- Veterinary and Livestock.
- Irrigation and drainage.
- Metrology Unit (St. Lucia Bureau of Standards).
- The research unit handles soil testing and analysis.
- Facility is in Northern part of island.
- They are responsible for conducting soil analysis for farmers without any fees attached.
- Human resources: analytical chemist, food technologist, microbiologist, and technicians.

Infrastructure being used for soil management:

- Projects of biogas digesters and, composting.
- GIS maps. Department of physical planning updates LIDAR data through projects.
- The MOA has a drone team with trained technicians for conducting surveys and developments maps.
- The access for the information data is available upon request.
- The department of Forestry develops maps within mapping unit.

Local Educational Institutions for training in Water and Soil Analysis

Sir Arthur Lewis Community College is the primer tertiary learning institution; the faculty of agriculture provides training for future extension officers, farmers, and collaborate with stakeholders in research works.





Problems for productive soil and/or constrains for water management:



- Macro level: indiscriminate dumping of plastics in the environment that for example contributes to flooding.
- Micro level: there is still inadequate study of plastics and their negative impact.
- Land degradation related to land use issues as pertains to encroachment into agricultural lands of urban developments.
- Deforestation
- Siltation
- Erosion
- Wastewater management issues (impacts from effluents from agriculture (livestock, agrochemicals))
- Low levels of fertility (phosphorus)
- Indiscriminate use of pesticides
- Acidity
- Compaction

Soil conservation practices of the producers:

- Mulching with dry grass or plastic mulch.
- Terracing
- Minimum Tillage
- Incorporation of organic matter to soil
- Composting
- Animal manure



Practices on collective and/or individual water management that farmers and water agencies carry out:

- Some farmers practice drip irrigation, some invested in storage tanks.
- The management of distribution of water is among farmers with collective systems.
- The development of projects is participatory, but the management of the system is of the farmer groups. Agreements are signed to establish the management of the system.

International Projects



- Morocco Soil Fertility Mapping Project (ongoing).
- "Project to assess groundwater resources" anticipated under the IHP (International Hydrological Programme) Project (being conceptualised).
- SOILCARE Project (ongoing) with Forestry Dept, UWI St. Augustine, CARICOM.
- Adaptation Fund (objective to build resilience to climate change) (ongoing – just started).
- Assessment and Rehabilitation of 5 major rivers in Saint Lucia.
- Consultancy services for the preparation of designs for check dams and riverbank stabilization for the Vieux Fort River (CDB: procurement is in progress).
- Supporting water conservation and use of rainwater harvesting (RWH) in St. Lucia (DVRP World Bank: completed).
- GCF Concept – Building water resilience in St. Lucia.
- Integrated Landscape Management (ILM) Project: Promoting sustainable livelihoods through Integrated Land Management (EU-OECS - in planning stage, like IWECO, under Forestry).
- IWECO (ongoing).
- Southeast Coast Project (ongoing).
- Northeast Coast Project (Iyanola) (ongoing).
- ACP-GCCC+ project: Improving water availability at three (3) educational institutions in the south of St. Lucia (EU- OECS - in planning stage).
- ACP – MEAS Project, coordinated by FAO on slope stabilization, on riverbanks and watershed areas.
- Addressing the Water Quality Issues Faced in the Soufriere Watershed and the Soufriere Bay by Strengthening Policies, Water Quality Monitoring and Fostering Community Awareness.
- "Strengthening water and soil resource management for the sustainability of agro-food systems in Caribbean countries in the context of the COVID-19 pandemic" with German and Argentine Cooperation (2020-2023).



Saint Lucia needs for the sustainable management of water and soil resources.



SHORT TERM

- Set up demonstration plots showcasing climate resilient farming techniques.
- Facilitate farmers training on climate resilient agriculture through farmer field schools.
- Develop training for new and existing extension officers using non-private lands or Memorandum of Understanding.
- Introduce alternative heat and drought tolerant crop varieties; crop varieties with a higher harvest index (improving water use and irrigation efficiency); non-transgenic, where possible.
- Adopt CRA best practices to extend the use of soil and water and energy-efficient conservation measures (mulching, appropriate terracing, drip irrigation, solar pump, wind power, etc.) to reduce water losses and erosion.
- Strengthen implementation of Good Agriculture Practices (GAP) and permaculture best practices to strengthen climate change resilience.
- Identify and adopt alternative agricultural management practices that improve water efficiency of livestock.
- Adopt a watershed management planning approach for zoning (e.g., within agroforestry system).
- Construct climate resilient infrastructure to improve water supply and storage for crops and livestock production (e.g., dams, water storage tanks) and improve farm drainage infrastructure, storm drains, cultivation and harvesting practices to reduce impacts of soil waterlogging stress during heavy precipitation periods.
- Adopt new water capture technologies and retrofit damaged water infrastructure (e.g., dams, ponds and swales for rainwater harvesting, groundwater abstraction) for use in agriculture.
- Strengthen existing facilities for soil and water quality testing.
- Set up agrometeorological and forecasting system for the planning of farm activities.
- Develop a new 20-year Integrated Water Resources.
- Management Strategy for Saint Lucia (incorporating water conservation and allocation strategies and climate change and other priorities in the Water SASAP).
- Revise the current water, land, and other policies to address climate change challenges and integrate coherently climate adaptation considerations.
- Undertake a comprehensive study of the 37 watersheds and all water resources in Saint Lucia to develop a comprehensive water resources database, hydrological models, and a reporting system.
- Adopt forest management plans to reduce and control soil erosion, sedimentation of water sources and to minimize the risk of landslides.
- Activate or reactivate Community-based organizations for integrated watershed / natural resource management.
- Resumption of early warning systems (bulletin, audio, visual) forms in manner compatible with user's standard of education.
- Investment in more human resource personnel at National Diagnostic Facility to better represent the farmers such as: Plant Pathologist, Entomologist, Soil Scientist.
- Establishment of demonstration/ trial plots of: Resistance cultivar, GAP in soil and water management, smart agricultural practices.



- Investment in irrigation equipment and infrastructure such as pumps and reservoir.
- Assistance in land zoning/ agricultural land banks formation.
- Purchase of equipment for the Water Resource Unit such as soil probes and water testing paraphernalia.
- Assistance in upgrading Saint Lucia soil classification map (which is archaic since 1970).
- Review legislative enforcement policy of the Water Resource Management Unit for greater compliance by users.

MEDIUM TERM

- Integrate Saint Lucia and land use strategies into the Agriculture Policy Framework and Strategy (2016 to 2021)
- Implement Land Policy to enable land zoning to safeguard quality agricultural lands and identify lands best suited to produce specific crops.
- Improve soil testing and apply corresponding soil amelioration measures (e.g., leaching with fresh water).
- Develop and adopt alternative production systems such as aquaculture, mariculture, hydroponics, and aquaponics following CRA best practices.





CHAPTER IV

SAINT KITTS AND NEVIS

CHAPTER VI - SAINT KITTS AND NEVIS



By Kyle Flanders

Government priority



- Improving food and feed systems.
- Food and Nutrition Security, in the fight against hunger and malnutrition.
- Climate Change and resilience, focusing on the development of a water policy.

“THE THREE GOVERNMENT PRIORITY AREAS EMPHASIS ON THE CREATION OF SUSTAINABLE LIVELIHOODS AND FOOD PRODUCTION.” (FAO, 2017).

State of local situation regarding recent natural disasters and Covid-19 Issues



NATURAL DISASTERS

- Climate change cause greater use of water for irrigation (increased evapotranspiration, droughts etc.)

COVID-19 ISSUES

- Local or regional protocols or manuals of Good Agricultural Practices due to COVID pandemic: available but not used.





General island situation on the governance of soil and water



National and/or regional strategic policies or plans for the governance of natural resources.

Soil management:

- National Physical Development Plan (NPDP), which is a plan to govern the appropriate use and management of land in St. Kitts and Nevis (currently being revised, 15-year plan, reviewed every 5 years).

Water management:

- Chapter 11.06: Watercourses and Waterworks Act, an act to make provision for the regulation and supply of water for domestic and non-domestic purposes; and to make provision for related or incidental matters.

Governmental information



Governmental agencies or companies that are responsible of gathering information about soils and assessing the land:

- Ministry of Sustainable Development – Physical and Planning Unit
- Ministry of Environment (soil erosion outside agricultural lands, e.g., in protected areas, mangroves).

Water agencies or authorities:

- Water Services Department manages domestic and non-domestic water supply and infrastructure (including dams and reservoirs) – total authority for water.
- The Bureau of Standards handles the testing of water.

Water and Soil analysis:

- Soils Laboratory of the Ministry of Agriculture: limited testing capacity due to lack of resources; presently can only do rapid NPK tests but with adequate capacity, can test cations, pH, EC, organic matter, micronutrients.
- Bureau of Standards: have trained personnel, but the Inductively Coupled Plasma (ICP) machine is down so it is unable to conduct soil tests on this machine.



Institutions responsible for collecting and analyzing water quality, hydrology and social aspects for water planning and management:

Water Quality

- Water testing is available at the Bureau of Standards. ICP-OES (Inductively coupled plasma – optical emission spectrophotometry). This equipment can detect trace elements (heavy metals) and reveal some non-metals in water, and soil samples. Machine is not working; in the interim testing is conducted by a third party in the United States.
- Department of Water Services

Hydrology

- MET Office

Social Aspects and Management

- Water Services Department

Conventional, digital and/or satellite imagery/maps of your ecosystems that are updated and for public access: available.

- Can be used internally (public service).
- The public can have access on request.
- Have access to drones within agricultural dept.
- Ministry of Agriculture lacks physical resources for processing of data (google earth currently used within Dept agriculture but can obtain mapping layers (SHP files etc.) from Department of Physical Planning.



Problems/constraints for productive soil management:

- Limited knowledge among farming practitioners.
- Failure to practically apply knowledge.
- Need additional qualified persons within the public service to provide support to farmers.
- Extension services is understaffed.
- Regular issues (poor soil management) coupled with climate change incidents such as long periods of dry seasons can worsen impacts from hurricanes and other natural disasters.
- Most farmers still rely heavily on synthetics agrochemicals.
- Poor agronomic practices (excessive tillage, inadequate mulching, inefficient land prep, wind breaks etc.)
- Changes in land use – rural land conversion
- Extensive grazing patterns by livestock; many animals are free grazing/not controlled; over compaction of soil.
- Erosion along poorly managed slopes, commonly outside areas of agricultural use.



Main soil conservation practices that the producers undertake:

- Reduce chemical use.
- Drip irrigation.
- Composting initiative to encourage farmers to utilize organic methods of soil and moisture management.
- Ground cover and mulch are used to.
- Reduce soil erosion.
- Retain moisture.
- Reduce tillage.
- Conserve water.
- Slow weed growth.

Water technologies and infrastructure:

- Sprinkler use.
- Hose and nozzle use.
- Drip irrigation.
- Manmade dams, catchments.
- Rainwater harvesting.
- Water storage.
- Desalination plant used by one private property.
- Wastewater reuse (but is not directed toward agricultural production).



Main problems and practices on collective and/or individual water management that farmers and water agencies carry out:

- Drip irrigation.
- Manmade dams were constructed to capture precipitation that is utilized by farmers. Many have gotten damaged, so uncertainty as to how many are still operational; practice is encouraged by the Ministry.
- Greenhouse house production coupled with rainwater harvesting from roof of greenhouses; water is harvested from the roof and captured into tanks and the runoff stored in mini dams which are used to fertigate (greenhouses and small plots) irrigate crops.
- Farmers to utilize organic methods of soil and moisture management.
- Large capacity tanks used by farmers for water storage and irrigation.



Challenges inhibiting long term effectiveness and efficiency of these water technologies:

- Lack of implementation of know how in water harvesting.
- Limited skills in water harvesting practice.
- Cost implication for the 5% of farms that are irrigated by municipal source, as compared to use of non-potable water use.
- Most of the surface water collected (publicly managed water) is diverted to municipal potable supply; there is no designated water allocation for the agricultural sector.
- In overall water policy, the use of municipal water for agriculture is not mandated (settlements, industrial, commercial use are mandated recipients for supply; authority not obligated to supply water to the agricultural sector); this is under review.
- Cost to install irrigation is high.
- Infrastructural constraints (wells for water capture are not readily available; there is no financial support for operations and capital costs associated with these; lack of adequate access (road network) to water sources; lack of maintenance of accesses to water sources; inadequate access to energy to operate pumps).
- Limited dams.
- More frequent heatwaves; increased evapotranspiration; draughts.
- Limited knowledge on proper irrigation or poor irrigation practices (sprinkler use, hose, and nozzle, etc.).
- Poor irrigation structures for pressurized systems.
- Saltwater intrusion into ground water.

International Projects



- Cooperation for Adaptation and Resilience to Climate Change in the Caribbean (Mexico/ CARICOM/FAO). This project aims to address the water-energy nexus in agriculture, seeking to improve water resource efficiency to increase agricultural productivity, using technological innovations such as (micro-) solar powered irrigation systems to improve water efficiency and management and by improving access to clean and climate-smart energy to increase agricultural water productivity.
- Moroccan Soil Fertility Project (ongoing).
- IUCN – Improving Environmental Management through Sustainable Land Management in St. Kitts and Nevis (including among other aspects, restoration of degraded lands eg. Orchards - reforestation).
- “Strengthening water and soil resource management for the sustainability of agro-food systems in Caribbean countries in the context of the COVID-19 pandemic” with German and Argentine Cooperation (2020-2023).



Saint Kitts and Nevis needs for the sustainable management of water and soil resources.



State of local situation regarding recent natural disasters:

- Location of agricultural lands (most are in higher terrain so there is need for use of skills which are not within capacity of the farmers)
- Cost for implementation.
- Increased use of/pressure on finite land and water resources by persons who may not be adequately trained/knowledgeable in sustainable practices.
- Availability of inputs (eg. Ground cover, drip lines and accessories not readily available) and suitable planting material (eg suited to local environment)
- Culture of practitioners – mindset is aligned with conventional (unsustainable practices)
- Lack of adequate guidance within the existing land use policy to guide land users on the practices that can be allowed/employed within certain zones.
- Inadequate local resources/opportunities for training in sustainable practices
- Lack of technical capacity as relates to good soil and water management.
- Lack of adequate guidance within the existing land use policy to guide land users on the practices that can be allowed/employed within certain zones.
- Inadequate local resources/opportunities for training in sustainable practices
- Lack of technical capacity as relates to good soil and water management.

SHORT TERM

- Effective environmental health and biodiversity management
- Resilient agri-food systems
- Climate smart agricultural, fisheries and aquacultural practices scaled out.

MEDIUM-TERM

- Integrated land, soil water and coastal zone and ecosystems management.





CHAPTER VII

SAINT VINCENT AND THE GRENADINES

CHAPTER VII SAINT VINCENT AND THE GRENADINES



By Karomo Browne

Government priority



- Food and nutrition security.
- Resilience building against disaster and climate change.
- Improved market systems.
- Sustainable natural resource management.

“THE FOUR GOVERNMENT PRIORITY AREAS FOCUS ON CAPACITY BUILDING, POLICY FORMULATION, AGRICULTURAL PLANNING AND LEGISLATION DEVELOPMENT.”

(FAO, 2017).

State of local situation regarding recent natural disasters and Covid-19 Issues



NATURAL DISASTERS

- Still recovering from volcanic eruption, which occurred on the 9th of April 2021.

COVID-19 ISSUES

- Local or regional protocols or manuals of Good Agricultural Practices due to COVID pandemic: only drafts; never adopted.



General island situation on the governance of soil and water



National and/or regional strategic policies or plans for the governance of natural resources.

Sustainability of natural (land) resources:

Strategic priorities.

- Enhance climate change and disaster resilience in the agricultural sector.
- Modernizing the agricultural and fisheries sectors through promotion of ICTs and innovations among value chain actors.
- Facilitating scaling up of climate change and disaster risk management measures and mitigation strategies to reduce the risk and associated losses in the agricultural and fisheries sectors, improving resilience in the agricultural sector.

Natural Resources fall under Forestry.

- Protection of nations forests and wildlife reserve.
- Improvement of forest management plans to protect water resources and watershed areas.
- Improve and enhance agroforestry programme to support diversification, food security and sustained livelihoods.

Soil management:

- To increase provision of various services inc. soil testing, establishment of soil and water engineering services, pest management services and green house construction and repairs.

Water management:

- Natural Resources fall under Forestry.
- Protection of nations forests and wildlife reserve.
- Improvement of forest mgmt. plans to protect water resources and watershed areas.
- Improve and enhance agroforestry program to support diversification, food security and sustained livelihoods.



Governmental information



Governmental agencies or companies that are responsible of gathering information about soils and assessing the land:

- Soil Laboratory.
- Ministry of Agriculture, the Agricultural Department.
- Soil conservation promotion e.g. contour farming, contour drains, grass barriers.
- Soil testing for macroelements.
- Programs promoting composting.

Water agencies or authorities:

- Central Water and Sewerage Authority (CWSA). Tests for potable water, test taps, rivers, springs across the country, hydrology, social aspects of water planning and management. They are responsible for distribution of all potable water across the island. In times of disaster and drought, they provide water through water trucks. They are also responsible for water rationing.
- National Irrigation Authority (now defunct); provisions were not made for the sustainability of this intervention; the systems fell in state of disrepair; there is only 1 irrigation system running which is appx 75 acres.
- Fisheries Division has capacity in water quality testing.

Water and Soil analysis:

- Plant and Quarantine – soils laboratory (managed by the Ministry of Agriculture, Forestry, Fisheries, Rural Transformation, Industry and Labour).
- Organic matter
- pH
- macro nutrients
- There are limitations with microelements due to reagent availability and equipment accessibility challenges.

Conventional, digital and/or satellite imagery/maps of your ecosystems that are updated and for public access: available.

- The most recent map was done in 2007.
- Google maps is relied on.
- Forestry and fisheries have drones; agri will soon be receiving their own.

Infrastructure being used in Science, Technology and Rural Development:

- Catchments are mainly surface water which is directed to reservoirs and storage tanks (in SVG mainland).
- Mustique and Canouan practice desalination.
- The other Grenadines practice rainwater harvesting at domestic level.
- There was extensive use of ground water after the eruption; it generally remains untapped.

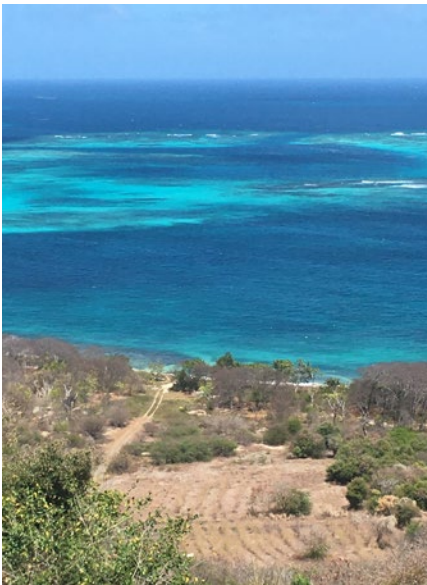


Challenges inhibiting long term effectiveness and efficiency of these water technologies:

- Lack of adaptation.
- Cost of water technology eg. Desalination – energy, membranes, pipes (applies to Mustique and Canouan).
- Mainland would not yet need to explore desal except there be some drastic changes in the weather conditions.

Local Educational Institutions for training in Water and Soil Analysis:

- SVG Community College – conducts an agriculture program (2 years).
- The University of the West Indies (UWI) offers training reference management issues (Gaius Eudoxie – UWI Professor – soil specialist) recently did training in March 2023 on soil management.
- Also benefitted from some training sponsored by USAID in soil and water management.
- Ministry of Agriculture also offers soil and water management training.





Soil and water conservation practices of the producers.



- Grass barriers. (*)
- Contour drains. (*)
- Planting along contours.
- Use of contour beds especially on steep slopes.
- Re banana production – lining of trash to reduce runoff rates.
- Planting of fruit trees on boundaries.
- A few farmers' collective water.

() Some of these are done independently by the farmers, but others are initiated/supported by the Ministry.*

Problems/constrains for productive soil management.

- Terrain – steep slopes; deforestation which leads to soil loss. Was associated with production of cannabis (illegal to cultivate in the forest, but there is medical marijuana production certificate). Prior to eruption (April 2021), most of the slopes of the volcano were covered with illegal marijuana. Cultural practices associated with certain crops eg. Planting ginger on slopes, the soil is loosened and left exposed. Use of contour drains and barriers are no longer practiced, and thus this has further compromised integrity of slopes and resulted in soil loss.
- Lack of a Land Use Policy – prime agricultural land is being converted to urban developments.
- In the short term, soil is inaccessible because of the volcanic eruption.

Problems/constrains for water management.

- Farmers do not use surface or ground water for irrigation; they use potable water depending on the location. Most are rain fed. During dry season, potable water is used for irrigation. There is huge potential for alternative water sources; the farms are usually in the high lands, but the rivers are to the lower elevations, so water has to be pumped up to the farms. In late 90s there were several irrigation (pipes) schemes covering approximately 1000 acres under funds from STABEX. Richmond, Vermont, Orange Hill have remnants of earthen canals. From the traditional systems of the 90s only the Langley Park system is still functional, it has potential to feed 75 acres but only 15 acres are being irrigated using the system. It is river water and gravity fed.
- Need for increase in on-farm water storage capacity. There is limited on-farm storage of water.
- Continued education of farmers on the importance of water management in crops and livestock.
- Changes in weather patterns continue to impact production; increase in heavy rainfall, less rain days.



International Projects



- Morocco soil mapping – ongoing.
- Taiwan Technical Mission Soils Laboratory – ongoing.
- REACH Project – real time weather (CIMH – Italy) – ongoing.
- Two hydroelectric facilities (Spring village and South Rivers (recently upgraded)) with VINLEC. 20% at peak production.
- Expansion of storage of fresh water by Central Water and Sewerage Authority (distribution of pipe borne water island wide and storage facilities for pipe borne water).
- Georgetown watershed project (IWECO) ongoing by Forestry Department.
- “Strengthening water and soil resource management for the sustainability of agro-food systems in Caribbean countries in the context of the COVID-19 pandemic” with German and Argentine Cooperation (2020-2023).





Saint Vincent and the Grenadines needs for the sustainable management of water and soil resources.



SHORT AND MEDIUM TERM

- Needs for increase in on farm water storage capacity because most farmers are not near the river so this needs to be addressed.
- Continued education of farmers on the importance of water management in crops and livestock.
- Low use of surface water by farmers.
- Strengthening the agricultural sector after the volcanic eruption
- Evaluation of the impact of ashfall on soils throughout the country.
- Need for land zoning policies.



A woman with curly hair, wearing a light-colored shirt, is crouching in a greenhouse. She is smiling and looking towards the camera. The greenhouse is filled with various plants, including what appears to be a tomato plant. The background is slightly blurred, showing the structure of the greenhouse and more plants. The overall tone is green and natural.

CHAPTER VIII

ACTIONS FOR THE SUSTAINABILITY
OF AGRIFOOD SYSTEMS IN THE
CARIBBEAN COUNTRIES.

CHAPTER VIII

ACTIONS FOR THE SUSTAINABILITY OF AGRIFOOD SYSTEMS IN THE CARIBBEAN COUNTRIES

“INNOVATION AND INVESTMENT IN AGRICULTURE RESEARCH AND PRODUCTION IS CRUCIAL IN THE FIGHT AGAINST HUNGER”

JOSÉ GRAZIANO DA SILVA (FAO, 2017)

The overall objective of the project regional and triangular cooperation project between partners from Argentina, Germany and the Caribbean region was to develop participatory planning strategies and technologies for the governance and management of water and soil resources in Caribbean countries, in the context of COVID-19 pandemic, to contribute to the sustainability of the region's agri-food systems.

To assist in the achievement of the expected results special regional and bilateral virtual seminars, and international missions were organized. These facilitated the achievement of the material presented in Chapters I to VII. Also technical trainings, laboratory activities and demonstration units on sustainable soil and water management technologies, were implemented.

The virtual trainings, presented by INTA specialists, covered the following topics:

- soil fertility, soil erosion control, laboratory techniques for soil analysis,
- adaptive water management, harvesting, pumping, conveyance, storage, and water distribution, efficient use of water and irrigation systems.

The training from the INTA distance education campus reached more than 130 people (48% Saint Lucia, 14% Grenada, 9% Antigua and Barbuda, 9% Dominica, 9% Saint Kitts and Nevis, 7% Saint Vincent and the Grenadines and 4% Barbados). More information of the virtual course is presented in Annex II.

Three technical missions were conducted in the Caribbean region. In-person trainings were held in Saint Lucia, Saint Kitts and Nevis, Saint Vincent and the Grenadines, Antigua and Barbuda, and Barbados. More than 120 people participated, including ministerial officials, agricultural specialists, students, men, women, and young representatives of productive communities participated. More information about the missions is presented in Annex II.

2. The project promoted the realization of international missions that facilitated the exchange between officials, ministerial focal points, technical referents, students and productive communities of the Caribbean with officials and specialists in agricultural research, and international cooperation from Germany and Argentina. In 2022 and 2023, four missions were carried out: the first was in Saint Lucia, attended by Caribbean focal points and political and technical representatives from Germany and Argentina (May 2022). The second mission consisted of the visit of the Caribbean focal points to Argentina (September 2022). The third was from a political and technical team from Germany and Argentina to Saint Lucia, Saint Vincent and the Grenadines, Saint Kitts and Nevis, and Antigua and Barbuda (May 2023), as well as the last one that took place in Barbados (August 2023).

Also, the Caribbean Focal Points participated in a special mission to Argentina during which there was exchange of experiences between the technical teams; the interactions highlighted the need to strengthen capacities in various aspects of management and adaptation of agricultural systems to extreme weather conditions. More information about the mission is presented in Annex II

Mid-way through the execution of the project it was jointly agreed (INTA and Focal Points from the various Caribbean Islands) that there would be development of a principal demonstration plot that integrates good practices and technologies for soil and water governance in Saint Lucia and located in Sir Arthur Lewis College. It was further agreed that funding also be directed toward the evaluation and execution of improvements to agricultural infrastructure in communities in the other six Caribbean partner countries of the project.

Based on this decision, the administrative and management tasks of the project were activated. The scoping and definition of specifications was quite a difficult task, but by August 2023, these were resolved.

The commitments reached will allow the development of the following lots:

Saint Lucia, with 30,000 Euros, planned its implementations to be done at the Sir Arthur Lewis Community College Farm. This would involve three solutions:

- Retrofitting roofs with rainwater harvesting infrastructure that will convey water collected to the pond and tanks to be used by different units of the farm.
- Design and built storm water diversion drains along with silt traps to minimize flooding and siltation in alluvial basin; and
- Establish of one acre with drip irrigation to demonstrate effective use of water, use of fertigation and mulching to conserve soil moisture.



On the other hand, with 8,000 Euros as budget allocated by country:

Barbados requested funds were targeted toward training on soil sampling and interpretation of analytical results, particularly for small farmers. For a future joint project, there is the expectation to advance in the design of an irrigation water distribution system for small/micro farmers like the Picada Union community water supply (from a spring source) which was visited in Argentine 2022.

Grenada applied to move forward with the installation of new plastic water storage tanks and irrigation system at the Mirabeau Farm School in response to inefficient crop irrigation, insufficient water for livestock production and pensanitization.

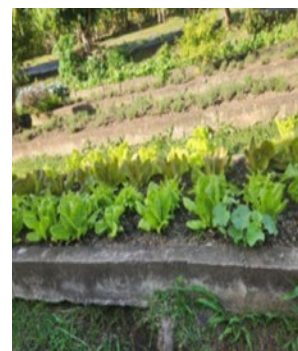
Saint Kitts and Nevis has required the development of a sustainable spring water and rainwater harvesting system, specifically for the Gideon Force farm. There, the roofs will be retrofitted with rainwater collection infrastructure that will transport the water to the tanks for irrigation use on the different farm quadrants. This will be connected to a drip irrigation system to emphasize effective water use, fertigation, and the benefits of mulching to conserve soil moisture. This initiative will demonstrate a farm with very good soil and water management practices which also at macro scale minimize negative impacts of high-water flows and erosion down-slope of the farm.

St. Vincent and the Grenadines focused the development of the lot on the island of Mayreau because it suffers from water stress for most of the year (the island records on average less than 600mm of rain annually). The agricultural and livestock activities are therefore limited. The agricultural activity on Mayreau has been limited to fruit trees and planting of corn, peas, and potatoes during the rainy season, which runs from June to December. Livestock is limited to goats which have become adapted to the native vegetation which exists on island. Most of the fruits, vegetables and tubers consumed on the island are imported from the main island, St. Vincent.

Persons on the island have expressed interest in developing back yard garden initiatives, starting with a pilot at the Mayreau Government School. This has commenced and is an ongoing Hydroponics Initiative. However, a critical component of this is water storage. Thus, the funds allocated by the project to the island of Mayreau are for the purchase of tanks and shed for water capture will be located at the Mayreau Government School. The principal beneficiaries will be the students and administration at the school, and the secondary beneficiaries will be the persons who reside permanently in the surrounding communities.

Unfortunately, **Antigua and Barbuda, and Dominica** could not respond to the administrative procedures necessary for the construction of hillside contour drains in the Body Ponds in the Bendals community of Antigua and Barbuda. Or with the procurement to adequate water for irrigation during dry season and prolonged drought periods in the farming area of Morne Prosper in Dominica. Given the challenges encountered, the support for this initiative will be evaluated in a future cooperation project.

Finally, as the project advanced mainly in the post-COVID era and focused on the development of training and the development of lots, as observed in this report, the analysis reveals insufficient guides or protocols in safety and hygiene to improve the sustainability of agri-food systems in the Caribbean, if a new pandemic materializes. Therefore, it was recommended that a Manual of Good Agricultural Practices addressing post COVID-19 pandemic challenges be drawn up to contain information accessible and relevant to the target populations of the Caribbean Islands.



The site would be managed by farmers of Gideon Force farm with collaboration from water services and agricultural extension officers from the Department of Agriculture in the Ministry of Agriculture.

An aerial photograph of a vast coffee plantation, showing rows of coffee bushes stretching across a valley. In the background, a small house is visible on a hillside, and the landscape is framed by distant mountains under a hazy sky. The entire image has a green color overlay.

CONCLUSIONS

CONCLUSIONS

During the project “Strengthening water and soil resource management for the sustainability of agro-food systems in Caribbean countries in the context of the COVID-19 pandemic” different spaces were created to identify the capacities, possibilities and needs on food production, soil, and water management in each of the partner countries.

Having considered the characteristics of the countries involved, it was possible to detect various edaphoclimatic conditions. This was considering the topography, environment, and climate of each of the countries. On one hand, productive situations were observed in soils with extreme slopes (e.g.: Saint Lucia, Dominica, and Saint Vincent & the Grenadines) and, on the other, practices associated with flatter terrain were detected (e.g.: Antigua, Barbuda, and Grenada).

Regarding water resources, according to the professionals consulted, there are notable differences between environments and countries in terms of availability, occurrence, and accessibility. In some places there is supply of surface water, through rivers and permanent streams, and in others the possibility of using groundwater as a resource for irrigation is being evaluated and explored. In other places the provision of water is carried out exclusively from the harvest of rainwater and the operation of desalination plants (e.g.: minor islands that form part of Saint Vincent and the Grenadines).

Government support and institutionalized capacities in water and soil management research and extension are also diverse. Those capacities vary in the amount of resources availability (human, physical and financial) associated with the productive sectors.

However, there are national institutes that have adequate instruments and laboratory equipment but with few personnel or specialists who could potentially be trained for the further development of their skills, abilities, and knowledge within the framework of international cooperation programs.

Soil resource

The technical representatives of the countries with agricultural areas located in mountainous relief or with excessive slope commented on the challenges that they face, and the need to evaluate different sustainable management practices to preserve the soil and reduce its erosion.

During the mission of the set of focal points to Saint Lucia (May 2022) it was possible to appreciate the production on mountain slopes where tests of conservation practices were carried out, such as the fixation of substrate with trees and shrub species, and the use of legumes for adding nitrogen to the soil. In these environments it will be essential to evaluate the impact of such management in terms of soil erosion and its effect on chemical, physical and microbiological fertility.

In this sense, the counterpart of Santa Lucia proposed to incorporate these technologies into the demonstration plot, from the systematization of slopes with the implementation of runoff control channels. Likewise, other countries such as Antigua and Barbuda and Dominica proposed to implement soil conservation technologies in their demonstration sites, which will allow them to

evaluate soil losses due to erosion and their control through good practices such as contour lines and crop rotations.

From the information collected, it is observed that several national and international projects for the evaluation and mapping of soil fertility are underway, where the concentration of phosphorus in different regions is being studied, for example.

It was also evaluated how the transfer from government agencies to producers is carried out, in terms of soil fertility information and fertilizer use. The farmers interviewed during the mission to Saint Lucia commented that soil fertility is an important aspect, but secondary to their main concern, which is access to water for irrigation or consumption (human and animal).

During the mission of technicians from GIZ, SAGYP and INTA to Saint Lucia, Saint Vincent and the Grenadines, Antigua and Barbuda, and Saint Kitts and Nevis (May 2023), with respect to soil resources, a situation like Saint Lucia was observed in Saint Vincent: in peri-urban areas, crop production takes place on steep slopes, using as conservationist practices the coverage of soils with residues and terraced crops. St. Kitts also worked on sloping soils where soil cover and the use of other conservation practices are necessary to reduce soil erosion (crop rotations, agroforestry systems, organic production, etc.).

In the case of Antigua and Barbuda, the land in some cases is flat and in others has a steep slope, so depending on the area different conservation practices must be used. In areas of excessive slope, work is being done on the construction and maintenance of terraces and diversion terraces and channels to control the exceeding runoff, to reduce soil erosion. The use of fast-growing tree species to increase soil retention by tree roots and the use of leguminous species to provide nitrogen to the soil (an essential nutrient for food production) is also being evaluated. In areas of slope, erosion control also allows to increase the infiltration of water into the soil by increasing the water useful for crops and filtering the water so that it circulates underground to the water reservoirs.

In the last mission, experts from Argentina (Ministry of Foreign Affairs and INTA) went to Barbados carried out meetings with the local authorities and develop training activities in soil management at the facilities of the Animal Nutrition Unit. Also, the presentations "Soil Sampling, why, dos and don'ts" take place with a soil sampling field exercise.

In summary, interests of the Caribbean partners revolve around soil fertility (e.g., soil sampling, laboratory analysis and interpretation of results).

Finally, the need to strengthen the knowledge of farmers on soil sampling and the correct use of the interpretation of laboratory analysis results (characterization, evaluation of soil quality, generation of nutrient balances, realization of fertilization plans, etc.) was revealed.

Attention was also focused on collecting data on laboratory resources and infrastructure for soil and water sample analysis, information detailed in each of the countries dedicated chapters.

Water resource

Caribbean partners described it as the most limiting resource for food production. Therefore, there was an important exchange of experiences among the technicians, who detailed the limitation of water in certain productive periods, according to the seasonal pattern of rainfall. It is worth mentioning

that the regularity in the alternation and occurrence of rainy and dry periods throughout the year has been modified due to climate change, exacerbating extreme events such as storms, torrential rains, and prolonged droughts. This motivates us to think about new strategies to strengthen water security in rural populations, in which the adoption of appropriate technologies, such as rainwater harvesting at the family, farm, and community levels, is desirable.

Specifically, the main demands are based on the evaluation of different irrigation systems, rainwater collection and conduction, exploration, and possibility of joint use of surface and groundwater, among others.

The first mission to Saint Lucia allowed technical representatives from Caribbean countries to visit agrometeorological and hydrological stations (for early warning purposes against flash floods), irrigation districts with storage and conduction infrastructure, agroforestry experiences for watershed management, and Sir Arthur Lewis Community College demonstration farm. Visits were also made to science and technology institutions linked to the diagnosis of water and soil quality (National Diagnostic Facility and CARPHA).

During the visits to the demonstration lots, many water management challenges were also noticed in Mayreau Government School (Mayreau Island, Saint Vincent and the Grenadines), Body Ponds Area (Antigua and Barbuda), and Gideon Force Cooperative farm (Saint Kitts and Nevis). The visit to Mayreau highlighted how critical the implementation of rainwater harvesting technology is due to the lack of reliable water sources both surface and ground originated. This dependence on meteoric water was also evident in Antigua and Barbuda, where high degree of adoption of catchment systems (SCALL) could be observed, both in private and institutional buildings.

Experience in Argentina

During the mission in Argentina, the Caribbean representatives toured different Regional Centers and Experimental Stations of INTA, farms, and agricultural cooperatives in the provinces of Misiones and Chaco to observe good extension practices, technologies and experiences of water and soil management in agroclimatic conditions like those of the Caribbean.

Representatives expressed their interest in the protection of springs, accompanied by recompositing and restoration of the overlying soil, as techniques for the prevention of pollution. They were also interested in rainwater harvesting and the use of concrete plate cisterns as an alternative for storing the volumes harvested with these techniques. They highlighted the environmental similarities between both regions of Latin America. For example, the conditions of aridity that may occur in Antigua and Barbuda as in the province of Chaco. Likewise, technological alternatives such as the protection of springs applied in the province of Misiones, could be replicated in other regions with similar water sources, such as Saint Kitts and Nevis.

Other topics addressed during this mission were related to the management and sustainability of community water works with the participation of farmers and communities, agroclimatology and agroecological techniques to improve water and soil management, such as intercropping. These techniques represent an excellent alternative for island regions, where high-slope agricultural areas predominate.

This meeting consolidated the relationship of mutual trust between the partners and allowed to define the joint work agreements for the remaining of the project.

Prospects

The partners in the Caribbean have multiple actor (government institutions, educational establishments, research, professional and technical organizations and producer communities) with capacities for the development and implementation of new activities in the field of water and soil resource management.

However, it is essential that international organizations continue to promote funds for the construction of cooperative development networks and provide economic support for structural investments and technological solutions adapted to the needs of local communities.

Likewise, progress must be made in the consolidation of government teams and specialists that promote the sustainable governance of natural resources. Priority should also be given to the training of human capital at different levels (students, technicians, laboratory professionals and extension workers). Also, it is necessary the provision of supplies and equipment for the refurbishment or development of new infrastructures for a sustainable governance of water and soil resources in the region, strengthening an adaptive approach.

Agricultural development approaches at the regional level are critical to harnessing comparative advantages and addressing specific challenges faced by each region. This may include implementing agricultural practices adapted to local conditions, improving rural infrastructure and access to markets, as well as promoting sustainable agricultural value chains.

In addition to national governments, it is crucial to involve supranational actors, such as international organizations and agencies specialized in agriculture and rural development. These actors can provide funding, technical expertise, and coordination to carry out effective projects and programs.

Undoubtedly, triangular cooperation can help strengthen public policies related to agriculture, food security and nutrition. This involves sharing good practices, lessons learned and successful approaches from different regions to inform and improve policies implemented in other areas.

In summary, as we have seen throughout the development of this Project, triangular cooperation in the field of regional agricultural developments can play a crucial role in achieving the Sustainable Development Goals related to agriculture, food security, sustainability, water management, climate action and life on land, among others. Once again, it is proven that collaboration between different actors and the transfer of resources and knowledge are key elements to address to address global challenges effectively.

A photograph of a person wearing a wide-brimmed hat and a light-colored shirt, standing in a field. The person is holding a large woven basket filled with fresh produce, including leafy greens and what appear to be small, round vegetables. The background is a dense field of similar plants. The entire image is overlaid with a semi-transparent teal color.

ANNEX

ANNEX I

PROJECT SUMMARY

TITLE: “Strengthening water and soil resource management for the sustainability of agro-food systems in Caribbean countries in the context of the COVID-19 pandemic”

Partner countries of the project:

- South provider: Argentina
- Traditional provider: Germany
- Beneficiary countries: Antigua and Barbuda, Barbados, Dominica, Grenada, St. Kitts and Nevis, St. Lucia, and St. Vincent and The Grenadines.

Project objective

The overall objective of the project is to develop participatory planning strategies and technologies for the governance and management of water and soil resources in Caribbean countries, in the context of COVID-19 pandemic to contribute to the sustainability of the region's agri-food systems.

Pillars of the project

- Regional report on the state of strategic planning of governance and management of water and soil resources in the Caribbean to survey, characterize and analyze current capacities.
- Trainings for the sustainable management of the soil/water binomial: face-to-face and distance technical training waiting to reach government officials and/or technical specialists, educational communities, associations and/or family producers in each of the Caribbean partner countries.
- Development of a Demonstrative Unit with technologies for the sustainable management of water (pilot / s in sowing and harvesting of water, rainwater harvesting systems, sources, surface and groundwater collection, conduction, storage, renewable energies, irrigation efficiency, irrigation systems, water suitability for agricultural and domestic use, monitoring of the water table and management at different scales) and soil for evaluation and management of fertility (chemistry, physical and biological); sampling, calicatas, infiltration tests, soil maps; erosion control: digital cartography, among other activities.
- Biosecurity: development of Guide/Protocol and/or Manual of Good Practices in safety and hygiene to improve the sustainability of agri-food systems in the Caribbean in the post-COVID context.

ANNEX II

First Mission Video:

Visit Saint Lucia, attended by Caribbean focal points and political and technical representatives from Germany and Argentina (May 2022).



Second Mission Video:

Visit of the Caribbean focal points to Argentina (September 2022).



Third Mission Video:

Visit of political and technical team from Germany and Argentina to Saint Lucia, Saint Vincent and the Grenadines, Saint Kitts and Nevis, and Antigua and Barbuda (May 2023)



Fourth Mission Video:

Visit of political and technical team from Argentina to Barbados (August 2023).



Resume video of INTA virtual course:

"Experiences in strategic water and soil management of the sustainability of agrifood systems".





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BARBADOS

Ministry of Agriculture and Food Security

Web sites: <https://agriculture.gov.bb/>; www.gov.bb/Ministries/agriculture

DOMINICA

Ministry of Agriculture, Food & Fisheries

Web site: <https://agriculture.gov.dm/>

GRENADA

Ministry of Agriculture, Lands, Forestry, Fisheries and Cooperatives

Web site:

www.adaptation-undp.org/partners/environment-unit-grenada-ministry-agriculture-lands-forestry-fisheries-and-environment

SAINT KITTS AND NEVIS

Minister of Agriculture, Cooperatives, Fisheries and Marine Resources

Web sites: www.gov.kn/agriculture-about-us/;

www.gov.kn/ministry-of-agriculture-fisheries-and-marine-resources-cooperatives-entrepreneurship-and-creative-economy/

SAINT LUCIA

Ministry of Agriculture, Fisheries, Food Security and Rural Development

Web sites: <https://agriculture.gout.lc/>; <https://moaslu.gout.lc/>;

<https://moaslu.gout.lc/agriculture-engineering-services-division/>

SAINT VINCENT AND THE GRENADINES

Ministry of Agriculture, Forestry, Fisheries, Rural Transformation, Industry and Labour

Web site: <https://agriculture.gov.uc/>

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FAO (2017). *Saint Lucia and FAO: Building sustainable agricultural systems and food and nutrition security*. Available at: <https://www.fao.org/3/AX425E/ax425e.pdf>. (researched, July 2021).

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A dense tropical forest of palm trees, with a teal overlay. The trees are tall and slender, with large fronds. The ground is covered in fallen palm fronds and other vegetation. The overall scene is lush and green, with a strong teal tint.

ACRONYMS

ACRONYMS

AESD: Agricultural Engineering Services Division.

AMEXCID: Mexican Agency for International Development Cooperation.

APUA: Antigua Public Utilities Authority.

BMS: Barbados Meteorological Services.

BMZ: German Federal Ministry for Economic Cooperation and Development.

CARDI: Caribbean Agricultural Research and Development Institute.

CariCOF: Caribbean Climate Outlook Forum.

CARICOM: Caribbean Community.

CARPHA: Caribbean Public Health Agency.

CDEMA: Caribbean Disaster Emergency Management Agency.

CDF: CARICOM Development Fund.

CELAC: Community of Latin American and Caribbean States.

CERMES: Centre for Resource Management and Environmental Studies.

CFA: Challenge Fund for Agriculture.

CIM: Centre for International Migration and Development.

CIMH: Caribbean Institute for Meteorology and Hydrology.

CSA: climate-smart agricultura.

CSIDS: Caribbean Small Island Developing States.

CWSA: Central Water and Sewerage Authority.

DFID: Department for International Development.

DMS: Department of Meteorological Services.

ACRONYMS

DOWASCO: Dominica Water and Sewage Company.

DRVP: Disaster Vulnerability Reduction Project.

FAO: Food and Agriculture Organization of the United Nations.

FCDO: Foreign, Commonwealth, and Development Office.

FOAR: Argentine Fund for International Cooperation.

GCF: Green Climate Fund.

GDB: Grenada Development Bank.

GDP: Gross Domestic Product.

GIZ: Deutsche Gesellschaft für Internationale Zusammenarbeit.

GNWIS: National Water Information System.

ICT: Information Communication Technology.

IICA: Inter-American Institute for Cooperation on Agriculture.

IKI: International Climate Initiative.

ILM: Integrated Landscape Management.

INASE: National Institute of Seeds.

INIDEP: National Institute for Fisheries Research and Development.

INTA: National Institute of Agricultural Technology.

INV: National Institute of Viticulture.

IWRM: Integrated Water Resources Management.

LDN: Land Degradation Neutrality.

MAFBA: Ministry of Foreign Affairs, Agriculture, Trade and Barbuda Affairs.

MBIA: Maurice Bishop International Airport.

MOALFC: Ministry of Agriculture, Lands, Forestry, Fisheries and Cooperatives.

NADMA: National Disaster Management Agency.

NAWASA: National Water and Sewage Authority.

ACRONYMS

NCTE: National Centre for Testing Excellence.

NPDP: National Physical Development Plan.

OECS: Organisation of Eastern Caribbean States.

PISLM: Partnership Initiative on Sustainable Land Management.

PPCR Project: Pilot Programme for Climate Resilience.

PURC: Public Utilities Regulatory Commission.

RO: Reverse Osmosis.

SAEP: Rural Enterprise Program.

SAGYP: Secretariat of Agriculture, Livestock and Fisheries of Argentina.

SENASA: Service on Health and and Agry-food Quality.

UNDP: UN Development Programme.

UNEP: United Nations Environment Programme.

UWI: University of the West Indies.

WCR: Wider Caribbean Region.

WIRRED: Walkers Institute for Regenerative Research, Education, and Design.

WRMA: Water Resource Management Agency.

WRMU: Water Resources Management Unit.

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Implementada por



Argentine Agency
for International Cooperation
and Humanitarian Assistance
White Helmets



Secretary of Agriculture,
Livestock, and Fisheries

Ministry of Economy

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Argentina