Resilience and comprehensive risk management in agriculture

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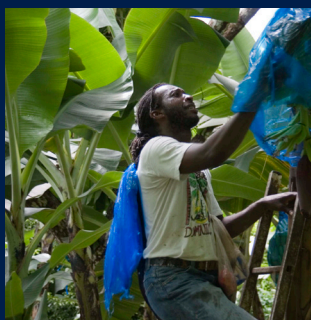
Intended Nationally Determined Contributions in the Caribbean:

Where does agriculture fit?



Intended Nationally Determined Contributions in the Caribbean:

Where does agriculture fit?

Authors: Kelly Witkowski, Daniela Medina and Mariana Garcia

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Editorial coordination: David Williams

Mechanical editing: Peter Leaver

Layout: Carlos Umaña

Cover design: Carlos Umaña

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Executive Summary

In recent years agriculture has taken on a much more visible role in the global climate negotiations. In the recent Paris Agreement, the priority of addressing climate change to ensure food security and reduce vulnerability of food production systems was defined more clearly than ever before. The level of commitment and priorities of each country in support of the Paris Agreement were made explicit in their intended nationally determined contributions (INDCs), submitted to the Secretariat of the United Nations Framework Convention on Climate Change. This study analyzes the relevance of such contributions and examines the way in which agriculture was addressed in the INDCs submitted by 15 countries in the Caribbean.

All but one of the Caribbean countries included the issue of agriculture in their respective INDC. The sector is addressed in the INDCs with the priority being on adaptation. However, more than half of the countries also included conditional mitigation targets that directly or indirectly relate to agriculture. The commitments made by all the countries denote the priority of the sector in the region's development goals and the need to channel technical and financial support for the sector. Agriculture also has great potential to achieve the integration of mitigation and adaptation approaches into policies, strategies and programs. The commitments made by each country, both through the Paris Agreement and in their respective INDCs, provide a solid foundation for tackling the global challenge of climate change with concrete actions keyed to national contexts and priorities.

Foreword

The 21st Conference of the Parties of the United Nations Framework Convention on Climate Change, celebrated in Paris in 2015, was a landmark event in the global efforts to confront climate change. Aside from the adoption of the Paris Climate Agreement by 195 countries, 187 submitted their Intended Nationally Determined Contributions – INDCs – wherein they specified the ways and means they would use to address climate change in their country, through both mitigation and adaptation measures, and committed themselves to take appropriate actions to reach their specified goals. In the process of developing their INDCs, the countries identified the priority sectors in which these actions would be taken, and most countries – including those of the Caribbean region – specified agriculture and food production as fundamentally important areas for action. Collectively, the countries, through their INDCs, have explicitly given a new and well-deserved prominence to the agriculture and livestock sectors, and the visibility that has been largely missing in the international climate change discussions prior to Paris.

The Inter-American Institute for Cooperation on Agriculture (IICA) is pleased to present this publication, which synthesizes how agriculture is addressed in the INDCs of the Caribbean region. Together with its partners, IICA has been working for several years to promote a more active and informed participation of the agriculture sector in the international climate negotiations and national planning processes. The Institute stands ready to support its member states as needed in following up on their INDC commitments such as strengthening capacity to fully integrate climate change considerations into the plans and actions the sector undertakes; developing public policy frameworks; providing guidance to assess agricultural adaptation needs; and promoting intersectoral collaboration to maximize the synergies and co-benefits of mitigation and adaptation actions.

The INDCs constitute a bottom-up recognition of the important contributions that the agriculture and livestock sector can make, not only in terms of reducing the greenhouse gas emissions generated by the sector, but also in bringing about the changes in policies and practices that will be needed to adapt the sector to novel climatic conditions in order to ensure the future food security of a burgeoning human population.

David E. Williams

IICA- San José, Costa Rica

The Paris Agreement as a basis for climate action

"Addressing climate change to increase our resilience to its unavoidable impacts has never been more urgent… As a Caribbean community, we have declared our recognition that climate change represents an urgent and potentially irreversible threat to our societies; as such, we have no alternative but to address these issues without delay."

Dr. Omar Figueroa, Belize Minister of State, Ministry of Agriculture, Forestry, Fisheries, Environment, and Sustainable Development

Since its establishment at the Rio Earth Summit in 1992, the United Nations Framework Convention on Climate Change (UNFCCC) has provided the umbrella structure under which 195 member states or "parties" have been negotiating how the world should address the global threat of climate change.

A key year for the international climate negotiations, 2015 culminated with the adoption of the Paris Climate Agreement at the Twenty-first Session of the Conference of the Parties (COP 21). This new agreement, scheduled to enter force in 2020 and replace the Kyoto Protocol of 19??, guides the commitments that each country has made to reduce greenhouse gas emissions, taking into account common but differentiated responsibilities, fairness, ambition and transparency. It strengthens the global resolve to meet the 2 degree Celsius limit on temperature increase, while encouraging movement towards a 1.5 degree limit. The agreement also raises the profile of adaptation, underlining the need for "enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the temperature goal" (UNFCCC 2015).

Agriculture occupied a much more prominent role in the COP 21 climate negotiations in Paris than ever before. Agriculture is one of the sectors most vulnerable to the impacts of climate change, and one that also holds great potential for mitigation. Increasingly, the agriculture sector has been taking steps to address these issues at the local, national, and regional levels.

The UNFCCC notes the importance of the sector in its ultimate objective, which states that greenhouse gases should be stabilized "within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner." In addition, the preamble of the Paris Agreement recognizes "the fundamental priority of safeguarding food security and ending hunger, and the particular vulnerabilities of food production systems to the adverse impacts of climate change" (UNFCCC 2015).

The Caribbean countries are well aware of the challenges and have responded by developing many different climate change strategies, policies, action plans and projects. Moreover, every country in the region has submitted a Nationally Determined Contribution (NDC) under the UNFCCC process. Worldwide, agriculture is included in the majority of the NDCs submitted. This document examines how agriculture was featured in the 15 NDCs submitted by Caribbean countries.[1]

1. The Dominican Republic is included in the analysis of Latin America, not this one, as the country is a member of the Central American Integration System (SICA).

Climate Change and Agriculture in the Caribbean

The vulnerability of Small Island Developing States (SIDS) to the impacts of climate change are well known, given the geographical and environmental context of such countries (IPCC 2014). Nations of this kind share similar sustainable development challenges, including small but growing populations, limited resources, remoteness, susceptibility to natural disasters and fragile environments, while agriculture is one of the sectors most affected by climate change (IPCC 2014) .

Agriculture makes an important contribution to the economic and social welfare of the Caribbean region (Tandon 2014). Many Caribbean economies are heavily dependent on the sector as a major contributor to GDP, with the share ranging from 8% in Jamaica to over 20% in Dominica and Guyana (Caribbean Development Bank 2014). Additionally, the sector makes important contributions to the region's livelihoods, rural development and food security (Tandon 2014). Agriculture provides around 16% of overall employment in the region, reaching levels as high as 30% in Guyana, 25% in Dominica, 20% in St. Lucia, and 18% in Jamaica (Tandon 2014).

According to a report from the Caribbean Development Bank (2014), the results achieved by the agriculture sector over the last few years have varied widely. While some of the major agro-producers experienced robust growth, adverse weather conditions and crop diseases negatively affected many others. In 2015 and 2016, El Nino Southern Oscillation events decreased precipitation and led to extended droughts in the region. Extreme weather events are also disrupting the sector more frequently. Hurricane Thomas in Dominica in 2010 and Tropical Storm Erika in Dominica in late 2015 resulted in losses totaling approximately USD 13 million (EC$ 35 million), mainly to banana and plantain production (St. Vincent and the Grenadines 2015). Impacts such as these are projected to increase in frequency and intensity, as global climate patterns continue to change (IPCC 2014).

What are INDCs and why are they important?

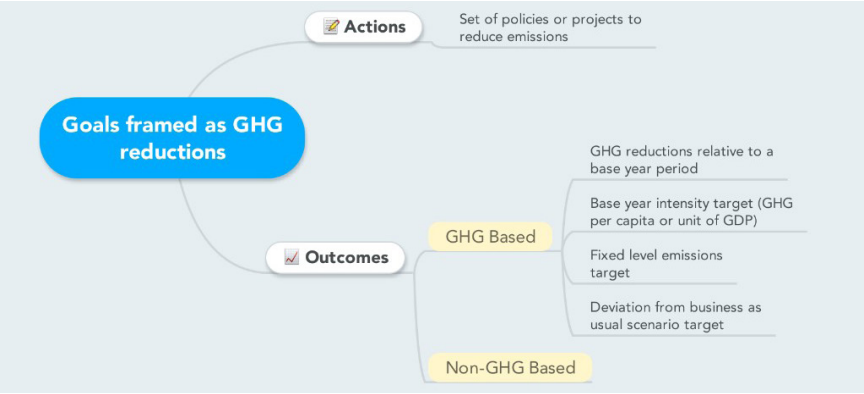
Intended nationally determined contributions (INDCs) are individual and voluntary commitments and goals for post-2020 climate action that both developed and developing countries submitted before or shortly after the COP 21, in December 2015. These documents clearly signal a country's priorities and intentions to the rest of the international community. Based on national priorities, circumstances and capabilities, the INDCs detail each party's goals and the actions they intend to take to achieve a low-carbon, climate-resilient future. All INDCs include a mitigation component, and the large majority also address adaptation concerns. This bottom-up process of goal definition allowed countries to establish their common but differentiated responsibilities (considering past and current emissions levels) and differing capacities. Once the Paris Agreement-- adopted during the COP 21 in December 2015 -- is ratified by each country, the INDCs will no longer be considered "intended" and are referred to simply as nationally determined contributions (NDCs).

INDCs are expected to provide clear, quantifiable goals, such as the period of implementation, scope and coverage, in order to facilitate understanding and transparency (UNFCCC 2014). They are also expected to be ambitious in terms of a country´s potential and capacity to achieve its commitments.

The mitigation components of the INDCs present outcomes, actions or both as actionable commitments, policies or projects that support greenhouse gas (GHG) reductions. When quantifiable, these goals allow comparison and aggregation, thus facilitating a better understanding of future levels of emissions reduction. Countries can also present their commitments in the form of outcomes, representing an intention to achieve the reduction of GHG emissions relative to a specific level through actions such as increases in renewable energy targets (Levin et al. 2015).

The following diagram describes the different types of goals reported as GHG reductions.

Figure 1. Types of INDC goals framed as GHG reductions



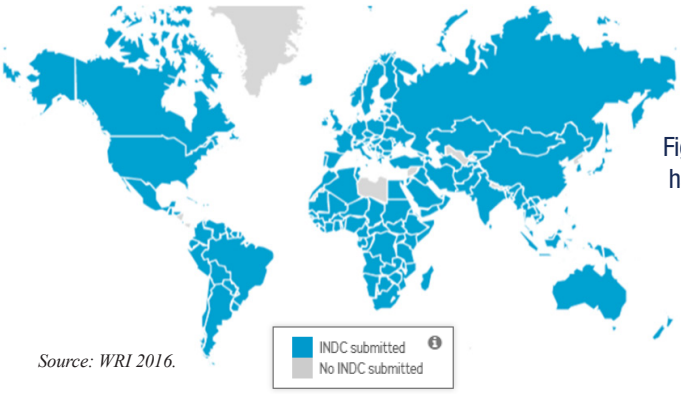
Based on Levin et al. 2015, International Partnership on Mitigation and MRV 2016.

Parties were also invited by the UNFCCC Secretariat to "consider communicating their undertakings in adaptation planning or consider including an adaptation component in their intended nationally determined contributions" (UNFCCC 2014). Summaries of climate change impacts and vulnerabilities, long-term adaptation goals, shorter-term actions, priorities, barriers, and support required to strengthen their resilience to climate change were included in the INDCs. In many cases, these factors were framed in terms of national goals (e. g., poverty reduction, food security) or sectoral plans. Submissions included both unconditional goals, as well as conditional goals that are contingent on external financial or technical support being received.

Scope of the global commitments

By March 30, 2016, the Convention had received 161 INDC submissions related to 189 countries, including the 28 European Union member states (Figure 2). Those 189 countries accounted for almost 99% of global emissions in 2010 (excluding land use, land use change and forestry - LULUCF) and 98% of the global population (CAIT 2016).

Of these submissions, 18 included only mitigation,[2] while 143 included both mitigation and adaptation.



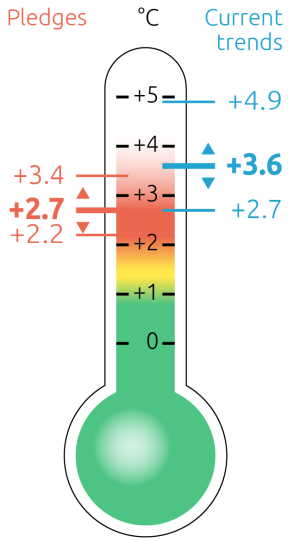
Source: WRI 2016.

Figure 2. Countries that have submitted INDCs (shown in blue)

2. In the Western Hemisphere, the United States of America, Canada, Trinidad and Tobago and Belize did not include adaptation, though the latter has plans to do so in the future.

As the UNFCCC did not mandate the format of the pledges, a number of countries presented their goals as different types of targets, as noted above. More than two thirds of the countries submitted GHG reduction targets. Some framed their contributions in terms of GHG reduction outcomes, e.g., a determined percentage reduction in GHG emissions by a specific year using another year as a baseline. Others framed their goals as non-GHG targets (for example, the achievement of a certain percentage of renewable energy by a certain year) or in terms of actions (such as the implementation of certain policies, projects, etc.) and several included more than one type of goal.

Figure 3. Global mean temperature increase (and uncertainty range) by 2100 above pre-industrial temperature



Source: Jeffery et al. 2015

The Copenhagen Accord of 2009 determined the 2 degrees Celsius target, which is indispensable to maintain climate change within the boundaries of manageable risks and our ability to adapt to climate change, and to achieve the Convention's ultimate objective (UNFCCC 2009).

In the Paris Agreement, Article 2 establishes the goal of "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change" (UNFCCC 2015: 22).

INDCs are expected to drive emissions downwards. Those submitted, however, even if fully achieved, would signify a temperature increase of approximately 2.7 or more degrees Celsius compared to the 3.3-3.9 °C degrees projected without them[3], yet are still insufficient to reach the targets as they currently stand (See Figure 3) (Climate Action Tracker Partners 2015). Actions taken in the short term will reduce the need for even steeper emissions cuts later, and are more than likely to be more cost effective (World Bank 2010).

The INDCs are certainly a step in the right direction, and they commit all countries to report regularly on their emissions. Stipulations were made in the agreement to ensure the goals are met and "ratcheted up" or increased in ambition over time. Countries will be required to submit emissions and progress reports on the implementation of their INDCs and develop revised, more ambitious plans every five years.

Scope of the INDC commitments made by the Caribbean region

The information presented below is based on the INDCs of the following 15 Caribbean countries: Antigua and Barbuda, The Bahamas, Barbados, Belize, Cuba, Dominica, Grenada, Guyana, Haiti, Jamaica, Saint Kitts and Nevis, Saint Vincent and the Grenadines, Saint Lucia, Suriname, and Trinidad and Tobago.

3. There are differing estimates of the temperature rise depending on the models and assumptions used, as well as the timeframes the different analyses cover. The conclusion arrived at is the same, however: that the actions to which the countries are committed are not sufficient to meet the 2 degree goal.

Despite the fact that the Lima Call for Climate Action of 2014 stipulated that Least Developed Countries (LDCs) and Small Island Developing States (SIDS) were not required to develop specific mitigation goals, but instead could "communicate information on strategies, plans and actions for low greenhouse gas emission development reflecting their special circumstances," the Caribbean countries included a mitigation section in their INDCs, and all 15 Caribbean NDCs included emissions reductions actions or targets (International Partnership on Mitigation and MRV 2016, UNFCCC 2015). With the exception of Belize and Trinidad and Tobago, all of them also included information on adaptation. Belize included information about its current Climate Change Action Plan to build resilience, and noted that it would be including further information on adaptation at a later time.

Many of the INDCs from the region highlighted the fact that, although the countries' emissions have been historically very small, and remain so, the nations concerned are among the most vulnerable to the impacts of climate change. Guyana and Suriname emphasized the fact that they are both net carbon sinks. Ten countries included cost estimates for the implementation of their INDCs, as shown in Table 1, and another ten make mention of the losses and damages they have suffered, or will suffer, as a result of climate change.

Table 1. Cost estimates for implementation of Caribbean INDCs.

Country	Antigua & Barbuda	The Bahamas	Cuba	Dominica	Grenada	Guyana	Haiti	St. Lucia	Suriname	Trinidad & Tobago
Costs of mitigation targets (USD)	220 million/ year	900 million to 2030	4 billion to 2030	99 million	161. 43 million to 2025	TBD	8.773 billion	218 million to 2030	2.492 billion	2 billion to 2030
Costs of adaptation targets (USD)	20 million/ year			25 million for 5 years		1.6 billion to 2025	16.614 billion		1 billion	

Note: Time-frames are included only when specified in the INDC.

The documents focused strongly on awareness raising, capacity building and preparing to access funding. The need for improved and downscaled climate modeling for the region and strengthened research on climate impacts was also mentioned in many of the INDCs.

Mitigation

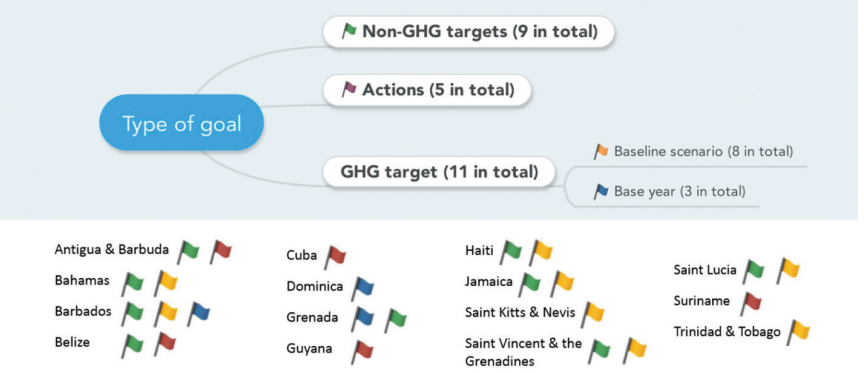
Energy was the sector most frequently mentioned; in fact, all 15 states included it. This was a strong focus of the region's INDCs, and many referenced the fact that the countries rely heavily on imported fossil fuels. Transportation, forestry and agriculture were also covered by at least half, with industry, waste management and land use also included by several countries. The GHGs covered by the INDCs are shown in Table 2. This is important because it shows that to achieve the goals of reducing methane (CH4) and nitrous oxide (N2O), the agriculture sector will be of key importance. Globally, the sector is responsible for 55%-60% of total CH4 emissions and 65%-80% of total N2O emissions (IPCC 2007). Emissions of methane and nitrous oxide increased by 0.9% per year for the period 1990-2010 with the most significant increases coming from developing countries (Tubiello et al. 2013, Smith et al. 2014).

Table 2: Types of greenhouse gases included in the Caribbean INDCs.

Type of GHG	Carbon dioxide (C02)	Methane	Metano (CH_4)	Hidrofluoro carbonos (HFC)	Otros (PFC, SF_6, NO, carbono negro)
Number of countries that included it in their INDC	15	12	11	4	2

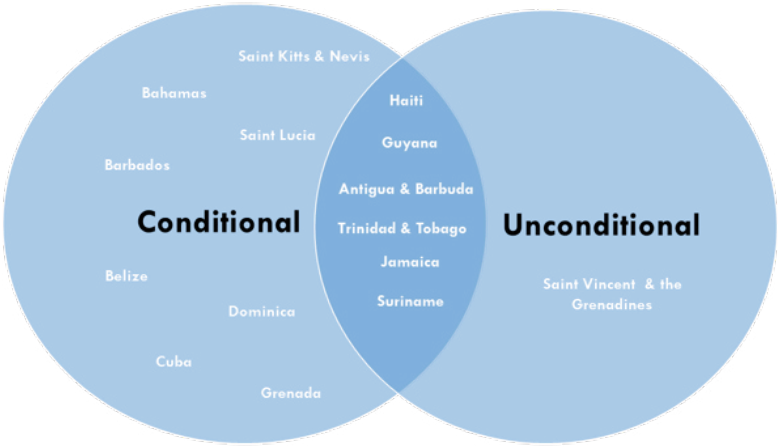
Various types of mitigation goals were presented by the Caribbean countries (See Figure 4 below). Seven countries specified both GHG and non-GHG targets, while three countries specified GHG targets, three presented actions only, and two presented both actions and a non-GHG target. All of the countries presenting non-GHG targets included renewable energy goals, and The Bahamas included other types of non-GHG targets as well. As high forest cover/low deforestation rate countries, Guyana and Suriname place a very strong emphasis on Reducing Emissions from Deforestation and Forest Degradation (REDD+).

Figure 4. Types of mitigation goals included in the Caribbean INDCs.



As shown in Figure 5, seven of the INDCs presented unconditional goals, while 14 presented goals that are contingent on receiving adequate levels of external support – financial support, investment, technology development and transfer, and/or capacity-building. St. Vincent and the Grenadines is the only country to present solely unconditional targets.

Figure 5. Conditionality of the Caribbean INDCs.



Many of the region's INDCs, including Antigua & Barbuda, Cuba, Dominica, Jamaica, and Trinidad & Tobago, clearly express a recognition of the co-benefits of mitigation (environmental, adaptation, cost savings, efficiency, etc.) and acknowledge that developing a low carbon economy will facilitate the achievement of their sustainable development goals.

Adaptation

Adaptation and building resilience are priority issues raised in the Caribbean INDCs. Thirteen of the 15 INDCs analyzed cover adaptation, as mentioned above. The sectors identified as most vulnerable to climate change include agriculture, water, fisheries, tourism, human health, and coastal resources, as well as human settlements.

Some of the most frequently mentioned impacts already being experienced and expected to increase in the future are a rise in temperature, increasing weather variability, changes in precipitation patterns, salt water intrusion, floods, droughts, and the increasing intensity of tropical storms. The expanding ranges of pests and diseases, limited freshwater availability, economic losses from extreme events, and declining agricultural productivity were also mentioned.

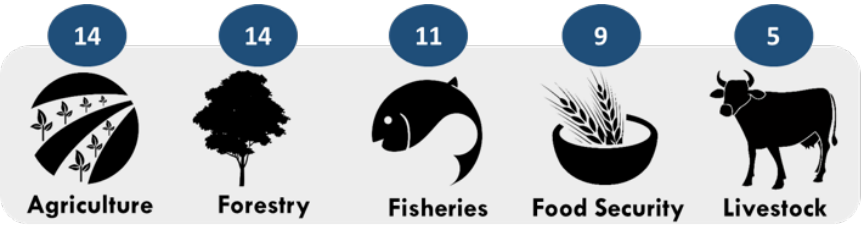
The gender perspective did not come out strongly in any of the INDCs. =nly two countries, Barbados and Dominica, made brief mention of women and youth as particularly vulnerable. Guyana and Suriname highlighted the vulnerability of indigenous groups, while Dominica and Trinidad & Tobago mentioned youth.

Agriculture in the Caribbean INDCs

The importance or promoting sustainable, climate-resilient agricultural production and enhancing food security in the region is reflected in the fact that 14 out of the 15 Caribbean countries included the topic of Agriculture in their INDCs. Twelve of the INDCs from the region make reference to the vulnerability of agriculture and food security to climate change and stress it as a priority for climate adaptation.

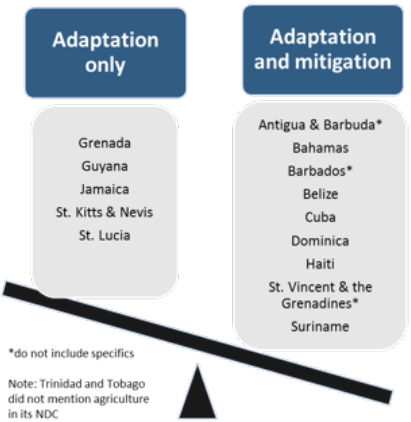
The INDCs highlighted the countries' dependence on the agriculture sector for economic and rural development, employment, food security, and foreign exchange earnings. The number of countries that included agriculture and its subsectors is shown in Figure 6. Sustainable management of fisheries, conservation of fisheries resources and the protection of reef ecosystems and marine habitats were mentioned as critical for many of the countries.

Figure 6. Number of countries that included agriculture and its subsectors in their INDCs.



Although the primary focus of the region's INDCs regarding agriculture was adaptation, six countries also included conditional actions or projects focusing on reducing emissions from the agriculture sector, as shown in Figure 7 below.

Figure 7. Inclusion of agriculture in the INDCs from an adaptation and/or mitigation perspective.



It is important to recognize that the agriculture sector, together with LULUCF, presents great opportunities for simultaneous mitigation and adaptation, often with additional co-benefits. Several countries stress the possible synergies between adaptation and mitigation, especially across the Agriculture, Forestry and Other Land Use (AFOLU) sector. Agroforestry systems, biofuels, mangrove restoration and the protection of wetlands, watersheds and forests are examples of planned synergistic adaptation-mitigation actions cited in a number of the INDCs.

Agriculture and mitigation

Although agriculture is one of the activities most vulnerable to climate change, it is also the source of 11% of global GHG emissions, and up to 24% if emissions from deforestation and land use change are taken into account (IPCC 2014). GHGs from the agriculture sector (including fishing) have almost doubled in the last 50 years and have the potential to increase further due to the burgeoning population and demand for food (Tubiello et al. 2014). In 2011, 25% of global GHGs from agriculture were produced in Latin America and the Caribbean (Tubiello et al. 2014), demonstrating the significance of emissions from the sector, though the large majority of these are from certain countries in Latin America.

"…agriculture is a considerable source of … GHG emissions, and should be part of the global mitigation agenda. However, for SIDS, LDCs and the African Group, agriculture is regarded as food production, food security, and rural livelihoods, and ... is under threat from the adverse effects of climate change, including floods and droughts. With this in mind, and in consideration of the fact that we have little emissions to reduce under mitigation, we will treat agriculture as an adaptation issue in this INDC, leaving the possibility that in future cycles we can review our position…"

- Guyana INDC

Due to its importance for food security, many countries did not commit to mitigation actions in the sector in their INDCs. However, nine countries have included conditional actions for mitigation from the sector, primarily linked to more efficiently using biomass to contribute to renewable energy plans, or to avoiding land use change, while one other (Guyana) has included adaptation actions in the sector that will also contribute to mitigation. Three nations – Antigua & Barbuda, Barbados, and St. Vincent & the Grenadines – include agriculture, but do not mention specific mitigation measures to be taken in the sector.

Antigua & Barbuda will reduce emissions from land use change through a conditional mitigation action: "By 2030, all remaining wetlands and watershed areas with carbon sequestration potential are protected as carbon sinks" (Antigua and Barbuda 2015:2).

Seven of the countries in the region specified the increased use of biofuels as part of their INDCs, which makes a contribution to both adaptation and mitigation. The Bahamas will put into place supporting legislation and infrastructure for use of biofuels in their transportation sector. Belize, Cuba and Dominica also focused their agricultural mitigation contributions on biofuels. Mentioning its socio-economic dependence on natural resources, especially forests, Belize's conditional contribution from the agriculture sector is to "Promote and facilitate clean production systems in the processing of agriculture and forestry outputs to co-produce bio-fuels and/or electricity" by promoting "the adoption of appropriate processing technologies to convert biomass from waste, forestry, agriculture and microbial production into food, feed, fiber, chemicals and energy (electricity, heat and bio-fuels)" (Belize 2015:4). This will be a contribution to Belize's Sustainable Energy Action Plan to improve energy efficiency and conservation. Cuba mentions that, given its

emissions profile, priority sectors for reduction include both energy and agriculture. As a conditional contribution to increasing renewable energy sources, Cuba will install 19 bioelectric plants connected to sugar cane processing mills that will provide 755 MW of energy from tree and sugarcane biomass, as well as solar-powered pumps for agricultural use, and capitalizing on organic residues (especially from animal production, industry and urban solid waste) for the production of biogas and biofertilizers to replace synthetic fertilizers. Dominica plans to reduce emissions from the commercial/institutional, residential, agriculture, forestry, and fishing sectors by 8.1% below 2014 levels by the year 2030. Specifically for the agriculture sector, the country will conditionally take action to reduce GHG emissions through the harnessing of biomass. Haiti, Guyana and Suriname also mention energy production from biomass in their INDCs,

Haiti includes conditional actions to reduce emissions from the Agriculture, Forestry and Other Land Use (AFOLU) sector by using legumes to improve pastures, preserving national forest parks, and promoting afforestation, reforestation and agroforestry.

Finally, Suriname is "undertaking a process of REDD+ Readiness at the national level and initial steps are being taken to assess the drivers of deforestation and to develop strategies, approaches and options among the key sectors including agriculture, logging and mining" (Suriname 2015:8). Their INDC also mentions a potential renewable energy contribution from the sector, pending necessary studies to "explore the potentials of biofuels with rice husk, various grass species, and micro algae as the biological source" (Suriname 2015:8).

These mitigation contributions from the agriculture sector do not directly affect current agriculture practices but rather focus on avoiding deforestation from the expansion of the agriculture frontier and on harnessing the potential of plant- or animal-based renewable energy sources.

Agriculture and adaptation

The Caribbean INDCs highlight the extreme vulnerability of the region's agriculture sector as well as vulnerabilities in the related sector of water resources, while emphasizing the need for policies and actions that enhance the resilience of the sector to climate change and at the same time increase food security and promote sustainable food production. Several of the climate-related risks and impacts featured in some of the INDCs include changes in precipitation quantity and patterns, extreme events, floods, droughts, salinization of land and aquifers, increased land degradation, decreased productivity and increasingly scarce freshwater resources.

Many countries highlighted proactive actions being taken, such as the incorporation of climate change into sectoral plans and strategies (Dominica, Barbados and others), a Climate Change Adaptation Policy approved in 2015 in St. Lucia that includes actions to enhance food security and promote sustainable land management, and agriculture sector adaptation strategies (Belize and Guyana already have one; The Bahamas, Jamaica and other countries are plan to develop them). St. Vincent mentions a commitment to agricultural diversification and support for small-scale farmers with regard to risk mitigation, production technologies and other adaptation-related topics.

A broad commitment is reflected in the Caribbean INDCs to foster a more resilient, climate-smart agricultural sector that provides for national food security. The Bahamas, Barbados, Cuba, Grenada, Jamaica, and St. Lucia mention agricultural adaptation generally and without much detail, citing the

sector's high level of vulnerability and the need to develop plans and policies to address this. Other countries, however, include more detail on some of the specific agricultural adaptation measures that are prioritized (see Table 3).

Most of the countries in the region are clearly prioritizing environmental sustainability, improved natural resource management, and ecosystem-based approaches that conserve the services they provide. These are low-regret adaptation measures. The conservation and restoration of forests, together with avoided deforestation, were mentioned in two thirds of the region's INDCs, and are central themes for Guyana and Suriname. Sustainable land management was mentioned in six INDCs. Another important topic, mentioned in nine of the INDCs, was the need for integrated water management and enhancing water use efficiency. Six countries are underscoring water collection and storage to help address the freshwater scarcity that seems to be increasing. Others will either improve or expand current irrigation systems. Antigua and Barbuda, The Bahamas, St. Kitts and Nevis, and St. Vincent and the Grenadines will all pursue an increase in their reverse osmosis or other desalinization efforts.

Four countries will explore strengthening insurance systems to cover losses from extreme events. Antigua and Barbuda included a specific conditional target of providing "an affordable insurance scheme … for farmers, fishers, and residential and business owners to cope with losses resulting from climate variability" by the year 2030 (Antigua and Barbuda 2015).

Noting the significant contribution that agriculture makes to the country's development, Belize's INDC notes that the Agriculture, Forestry and Other Land Use (AFOLU) sector is a priority for adaptation in their National Climate Change Policy Strategy and Action Plan, and that a National Agriculture Sector Adaptation Strategy to Address Climate Change in Belize has been developed. The latter includes both "short and long-term measures to address critical gaps in technological developments relevant to crop production, better soil management practices, diversification into drought resistant crops and livestock, and farm production adaptations which include, but is not limited to, land use, land topography and increasing use of low-water irrigation systems" (Belize 2015:6). Diversification is also important for St. Vincent and the Grenadines.

Other countries are prioritizing improved on farm practices as well, such as the development and use of flood, drought, saline and disease-resistant crop varieties, composting, fertigation, alternative feedstocks, agroforestry and others. For Haiti, agriculture, food security and water resources are a priority, and the country wishes to promote a bio-economy and climate-smart and organic farming, prioritizing measures such as the conservation of agrobiodiversity, land restoration, and others.

Table 3. Topics included in the 15 Caribbean INDCs.

		Antigua & Barbuda	Bahamas	Barbados	Belize	Cuba	Dominica	Grenada	Guyana	Haiti	Jamaica	St. Kitts & Nevis	St. Lucia	St. Vincent & the Grenadines	Suriname	Trinidad & Tobago	TOTAL
General Topics Mentioned	General vulnerability and importance of ag sector	x	x	x	x	x	x	x	x	x	x	x		x			12
	Ag adaptation planning and measures already in progress			x	x			x			x			x			5
	Support 1.5 degree C goal	x			x				x		x		x				5
Subsectors mentioned	Agriculture	x	x	x	x	x	x	x	x	x	x	x	x	x	x		14
	Forestry	x	x	x	x	x	x	x	x	x	x	x	x	x	x		14
	Marine and Coastal Resources	x	x	x	x	x	x	x	x	x	x	x	x	x	x		14
	Freshwater	x	x	x	x		x	x	x	x	x	x	x	x	x		13
	Fisheries	x	x	x	x	x	x	x		x	x	x		x			11
	Livestock		x		x	x				x		x					5
Support Needed	Adaptation Finance needed	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	15
	Technical or other support needed	x	x	x	x	x	x		x	x		x	x	x	x		12
	Loss and Damage	x	x	x		x	x			x	x		x	x	x		10
Priorities/ Adaptation Measures Included	Restoration and conservation of forests		x		x	x	x	x	x	x		x		x	x		10
	Improve water use efficiency and water management				x	x	x	x	x	x			x	x	x		9
	EbA/ecosystem goods and services/environmental stewardship		x		x	x		x	x	x	x			x	x		9
	Renewable energy from biomass/biofuels		x		x	x	x		x	x					x		7
	Water harvesting and storage						x	x	x	x		x	x	x			7
	Improved agro-climatic information and early warning systems					x	x		x	x	x		x				6
	Improved on farm ag practices				x		x		x	x		x		x			6
	Improve agricultural policies/strategies and their implementation; strengthen institutions		x			x		x			x			x			5
	Sustainable Land Management (including improved soil management)				x		x			x			x		x		5
	Desalinization	x	x									x		x			4
	Insurance	x					x		x	x							4
	Improved varieties				x				x	x							3
	Irrigation				x							x	x				3

Note: This table reflects the contents of the NDCs and does not include information from other sources

Off-farm agro-processing and agri-business management require strengthening in Haiti and St. Vincent and the Grenadines, while strengthening the collection and dissemination of climate monitoring systems is regarded as important to enhance the countries' preparedness. Strengthening the capacity of different actors to address climate change risks to food security is one of the 'soft' measures mentioned in many of the Caribbean INDCs.

The governments of the region plainly acknowledge the importance and vulnerability of the agriculture sector, and prioritize resilience-building in the agriculture sector to ensure food security and the achievement of other development goals. Strengthening practices through the use of improved varieties, diversification, improved natural resource management, rainwater harvesting and storage, desalinization, and integrated water resource management is an area that several countries in the region have prioritized. A combination of policy, research, incentives, capacity building and technical measures at the local, national and regional levels will be required to transform the Caribbean's agriculture into a low-emissions, climate-resilient sector.

Looking to the future

The year 2015 was a critical one for advancing the national commitments made towards climate action, not only through the UNFCCC process, but also through the approval of the Sendai Framework for Disaster Risk Reduction and the new Sustainable Development Goals. The success of these agreements will be gauged in the years ahead, as the political commitments made are translated into action on the ground at the regional, national and sub-national levels. This will likely require the evolution of public policy frameworks, and the materialization of sufficient funding and other forms of external support for developing countries. While seven countries will dedicate some national resources towards the implementation of the INDCs, all fifteen explicitly mentioned the need for additional financing, and 12 also refer to technical support, including capacity building and technology transfer. In this context, South-South and regional cooperation can play an important role.

The agriculture sector will play a central role in the achievement of the goals laid out in Paris and in the INDCs. However, the sector must become more engaged and more proactive in order to capitalize on the opportunities that these agreements provide. To take advantage of those opportunities, it will be crucial to channel both national and international resources - financing, knowledge, and technology towards the sector. Each country now faces the challenging task of articulating and aligning public policies, institutions and programs at different levels required to drive progress towards meeting the collective goals laid out in their INDCs. Given limited resources, countries will have to identify which adaptation measures provide the most benefit and which sectors will take on the responsibility and leadership for their implementation. Coordinating between sectors and stakeholders to achieve the goals effectively, and working together to mobilize the climate finance available, will be key tasks as well.

Agriculture can be a leader in mainstreaming both mitigation of and adaptation to climate change within the sector's policies, strategies and programs, which would help for countries to meet their food security, poverty reduction, environmental, and development goals. While the groundwork laid in 2015 and in the preceding years provides a solid foundation for confronting the global challenge of climate change, countries must continue raising their ambition levels. Time will tell if pre-2020 ambition and actions taken in the first implementation period of the INDCs will be sufficiently catalytic to stimulate the more determined commitments that will be required to effectively mitigate climate change in the upcoming years. In this context, the agriculture sector can be instrumental by exemplifying the synergies possible between adaptation and mitigation, as well as the close links between a healthy environment and human well-being.

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Inter-American Institute for Cooperation on Agriculture
Headquarters. P.O. Box 55-2200 • San Jose, Vazquez de Coronado,
San Isidro 11101 — Costa Rica
Phone: (506) 2216 0222 / Fax: (506) 2216 0233
e-mail: iicahq@iica.int
Website: www.iica.int