

Using scientific evidence to link private and public sectors in the planning process: Observations from coffee sector engagement in Nariño, Colombia

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Coffee farming is an important source of income for an estimated 40,000 farming families in the Department of Nariño in southwestern Colombia. Nariño is widely recognized as one of the world's leading origins of fine coffee, as measured by both the subjective preferences of leading specialty coffee companies and the objective standards of Nariño's Denomination of Origin. Despite the commercial success of Nariño's coffee in the marketplace, household-level data collected by CRS and CIAT suggest that most of Nariño's coffee farmers likely live in poverty, and recent investments of public resources to help growers create and capture additional value have not achieved their poverty reduction goals.

This policy brief describes how a participatory multi-stakeholder planning process in Nariño's coffee sector in 2012–2013, facilitated by credible third parties, succeeded in both introducing result-based evidence into the decision-making process and aligning the interests of the public and private sectors and civil society around a shared strategy to increase the sector's competitiveness. That strategy formed the basis of significant public investment in the coffee sector that involves key actors from the public, private, and non-profit sectors.

The process documented here is worthy of careful consideration by policymakers and private-sector firms interested in channeling scarce public resources toward market-responsive poverty reduction investments, development agencies seeking to contribute to lasting impact in the field, and research institutes seeking high-leverage applications of scientific evidence.

Key messages

- Participatory processes and facilitated dialogue can improve policy and support the efficient use of scarce public resources for poverty reduction by introducing result-based evidence into the decision-making process. Platforms for cross-sector engagement, whether temporary or permanent, can be effective in achieving alignment between the public sector, private sector, and civil society on sectoral plans.
- The development of policies and project interventions based on multidimensional analyses of production systems is essential for optimizing the impact of public and private investments. Such analyses enable efforts to optimize outcomes across multiple categories of impact (economic, environmental, social) and over time.
- Partnership between research institutes and development agencies rooted in an "intent to influence" holds the potential to help both be more effective – by contributing to public policies based on technical and scientific evidence, research institutes can leverage the public goods they create through their research for broad impact; while development agencies whose projects may have limited numbers of direct participants can achieve "lower intensity" impact at a much larger scale through more inclusive policies.
- Facilitation of multi-stakeholder engagement in the development and adoption of sectoral plans was effective in this case due to the ability of the facilitation agents, the perception of their credibility among participants in the process, their status as disinterested actors, and their ability to support and inform decision-making through the provision of result-based evidence. The swift adoption of the measures recommended by participants in this process, and public financing to implement those measures, was due to the existence of an enabling environment in Nariño, open to cross-sectoral collaboration and result-based evidence.
- New types of institutional organization and governance structures may be needed to develop strategies for adequately managing the risks and threats related to climatic variability and climate change, which will affect crop production in coffee-growing zones. It is important to note for policymaking purposes that these impacts will be geographically differentiated across communities based on environmental variables, production system, and livelihood strategies; and that effective policies will be customized for different segments of the population. The reasons for which the Government of Nariño failed to include provisions for climate change adaptation in its coffee sector investments, despite funding all other aspects recommended by this process, must be further analyzed. A preliminary analysis suggests that it may be a function of time horizons, both the long-time horizons of projected changes in coffee suitability and the misalignment of time horizons between scientific processes on the one hand and electoral and policymaking processes on the other.
- Finally, the most effective interventions in the coffee sector will be customized for different growers based on farmer typology and for different geographies based on agroecological, economic, and social variables. Moreover, the distinctive feature of territorial organization is that it is created and sustained by coffee farmers acting individually and collectively. Coffee farmers associations should be the core territorial organization structure, and this could improve both the competitiveness of the region as a whole and the performance of individual farmers. Of particular importance in developing differentiated interventions are rigorous baseline surveys, careful value-chain analyses and qualified technical assessments of the suitability of specific communities for the production of coffee in general and high-quality coffee in particular.

Context

Agroecological conditions in the Department of Nariño, Colombia, are ideal for producing two high-value crops with stimulant properties: coca and coffee. Since 2007, Nariño has been the leading coca-producing department in Colombia, and production has increased annually over each of the past 3 years despite the Government's commitment to eradication.¹ Coca production, processing, and transport in Nariño is both the cause and effect of the presence of armed actors in the department, both legal and illegal. These include units of the Colombian Army, two guerrilla movements – the *Fuerzas Armadas Revolucionarias de Colombia* (FARC) and the *Ejército de Liberación Nacional* (ELN) – and *bacrim*s (Spanish abbreviation for criminal bands), devoted to various illicit activities. Violence between and among these actors displaced more than 80,000 people in Nariño between 2008 and 2010.² Many of those displaced fled from the low-lying areas on Nariño's Pacific Coast where coca thrives to communities at higher elevations in Nariño's Andean region where some of the world's finest coffee is grown.

The coffee-growing municipalities of northern Nariño have been affected by violence both directly and indirectly: some have been the scene of violence that has displaced smallholder farmers, while others have seen smallholders displaced by violence elsewhere arrive in search of a new start. Furthermore, in 2012, coffee growers in Nariño had a 53% probability of falling below the national poverty line, and farmed on average less than one hectare of coffee.³ Market conditions were uncertain, and climatic conditions were progressively changing and increasingly variable, with risk factors potentially increasing in coming decades.

Against this backdrop, CRS introduced the Borderlands Coffee Project in Nariño in 2011 with support from the Howard G. Buffett Foundation and in partnership with CIAT and a range of local institutions. The project is working to facilitate inclusive value chains that unlock coffee's potential as a licit strategy to increase family incomes, reduce poverty and improve the quality of life for smallholder coffee farmers in Nariño.

Borderlands is a five-year initiative (2011–2016), coordinated by CRS, and implemented by three local partners in Nariño: Carcafé Foundation, a non-profit organization related to the Colombian coffee exporter Carcafé; the Pastoral Social Catholic Diocese-Ipiales (Caritas Ipiales); and the Pastoral Social Catholic Diocese-Pasto (Caritas Pasto). The project serves 1,600 smallholder coffee-growing families in eight municipalities. Its overall goal of increasing household incomes is anchored by efforts to expand smallholder access to high-value segments of the coffee market and consolidate inclusive coffee value chains. The project also invests in efforts to diversify farm production, smooth income streams, and improve the adaptive capacity of households confronting climate change. Finally, the project features a multi-faceted collaboration with CIAT, aimed at improving



A farmer in Colombia's Nariño Department checks her coffee plants. As part of the Borderlands Coffee Project, CRS and CIAT have been working with coffee farmers in southern Colombia and Ecuador to improve their access to high-value gourmet coffee markets abroad (Neil Palmer/CIAT).

outcomes for project participants and generating result-based evidence that improves decision-making on the farm, in the policymaking process, and in the industry. This "research-for-influence" collaboration between CRS and CIAT has delivered technical and scientific information to key regional actors in the public and private sectors to inform their decision-making in the coffee sector and facilitated a cross-sector planning process that achieved broad alignment among multiple actors on shared strategies to make Nariño's coffee sector more competitive. The Government of Nariño not only adopted those strategies as public policy toward the coffee sector, but it also invested approximately US\$4.5 million (as of this writing) to support the implementation of those strategies to strengthen the coffee value chain and approximately US\$567 million in related projects, including road infrastructure, irrigation, and food security.

Linking the public and private sectors

Within this project's "research-for-influence" framework (Figure 1, column C), CRS and CIAT joined efforts with the Government of Nariño (GON) and diverse local institutions (Figure 1, column B) with the aim of developing a strategy to improve the competitiveness⁴ and inclusiveness of the department's coffee chain. The process focused

1 See Colombia: Coca cultivation survey 2014. United Nations Office on Drugs and Crime, 2015 at <http://bit.ly/1QwONm5>

2 See web page *Síntesis de la violencia y la confrontación armada en Colombia 2010–2011* in "Observatorio de Derechos Humanos (DDHH) y Derecho Internacional Humanitario (DIH)" at <http://bit.ly/1POaWr9>

3 According to the reports issued by the Departmental Coffee Growers Committees to the National Congress; see years 2009 to 2013 at <http://bit.ly/1TksBfE>

4 A strategy for competitiveness comprises a group of activities planned and executed with the active participation of the diverse actors of a chain. The goal is to achieve common objectives, around which are articulated one or more business organizations and interest groups, with their focus broadened to the

on improving incomes for smallholder coffee growers by taking advantage of the coffee chain's latent potential and overcoming its limitations. Participating local institutions included: the Agency for Local Development in Nariño (ADEL); Carcafé Foundation, a non-profit organization related to the Colombian coffee exporter Carcafé; the National Coffee Growers Federation (FNC), which was represented by

its Departmental Committee for Nariño; the Pastoral Social Catholic Diocese-Ipiales (Caritas Ipiales); Pastoral Social Catholic Diocese-Pasto (Caritas Pasto); Suyusama, a rural development institute run by a religious order, the Society of Jesus, or Jesuits; and farmers associations from different coffee-growing regions of Nariño.

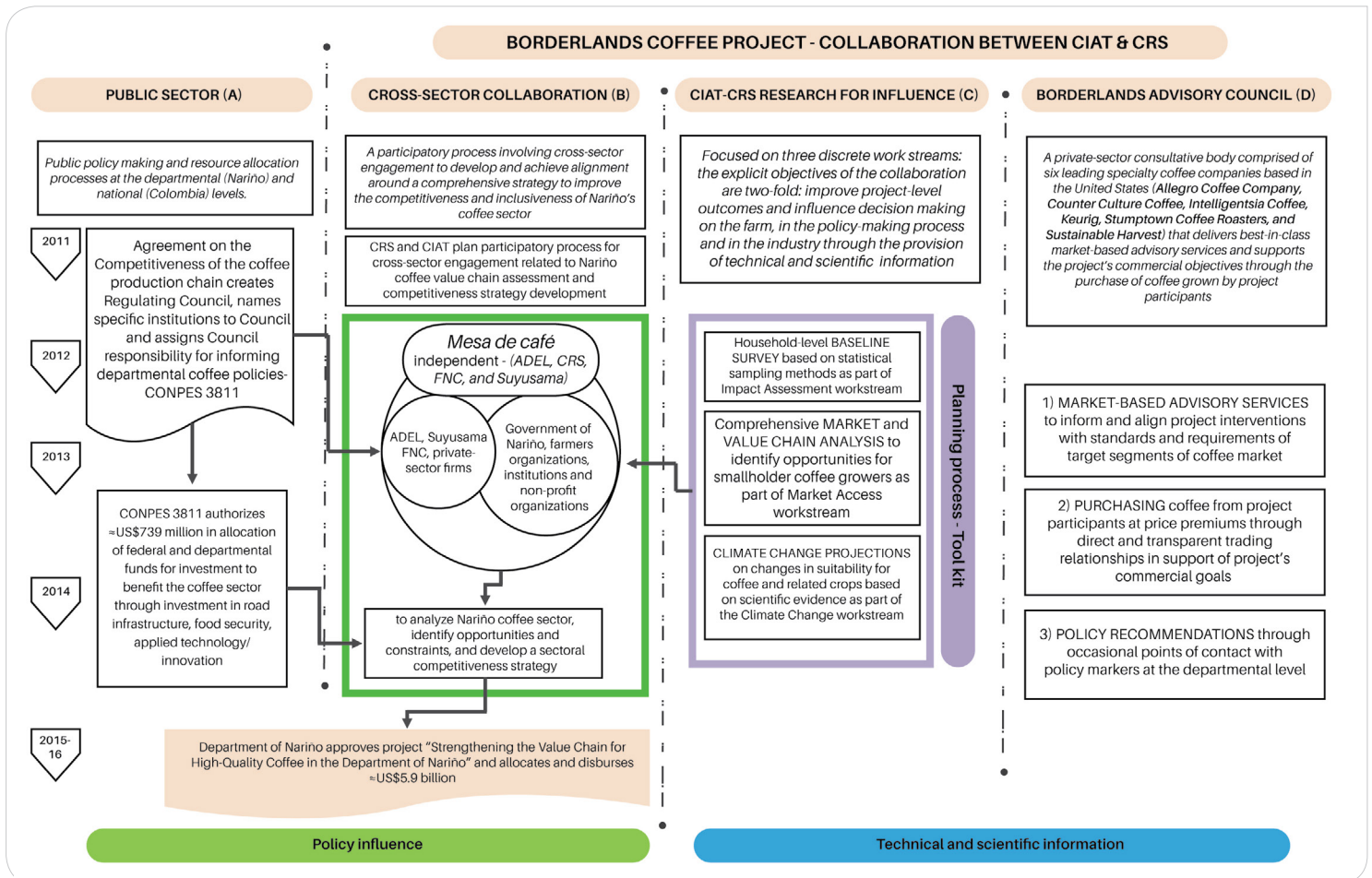


Figure 1. Models of influence in public policy, including timelines, key activities, and milestones in: (A) coffee-related commitments made by the public sector: Department of Nariño and Colombian National Council on Social and Economic Policy; (B) cross-sector engagement related to the Nariño coffee sector planning process; (C) the research-for-influence collaboration between CIAT and CRS in the context of the Borderlands Coffee Project; and (D) the work of the Borderlands Advisory Council, a process separately documented in a forthcoming CIAT policy brief on private-sector engagement in value-chain programming.

For this project, CRS also created a private-sector advisory body called the Borderlands Advisory Council (Figure 1, column D), comprised of six US-based specialty coffee companies, that delivers best-in-class market-based advisory services to project staff, partners, and participants, while supporting its commercial objectives through the purchase of coffee from project participants. The activities of the Borderlands Advisory Council may also be considered part of the project's influence over public policy and spending, as the project brought members of the Advisory Council into direct contact with policymakers as part of their annual visits to origin, during which they were able to offer perspectives and issue

recommendations on ways to more effectively foster the creation of a competitive and inclusive coffee sector. CIAT and CRS will analyze the Borderlands Advisory Council construct more thoroughly in a separate and forthcoming policy brief, including sections on lessons learned and recommendations.

Immediately prior to the start of the Borderlands project, the GON had adopted as a matter of public policy the Agreement on Competitiveness of the Coffee Production Chain, embodied in public guideline No. 2 of 30 March 2011. The policy calls for the establishment of a Regulating Council, comprised of representatives

production chain. This strategy is executed across the short, medium, and long term and, depending on the analyses of the production chain's critical points, can be directed at development and research on production operations, postharvest handling and processing, marketing, and business organization. Thus, competitiveness is improved (See Lundy et al., 2004 at <http://bit.ly/1nwA9QE>).

of local institutions involved in the coffee sector and charged with advising the Government on policies that would make the region's coffee value chain more competitive. The Agreement calls explicitly for the participation of diverse actors from the region's coffee sector. The GON, in other words, had already created a general enabling environment for cross-sector collaboration processes by the time Borderlands began and called more specifically for such a process in the coffee sector (Figure 1, column A).

Technical and scientific contributions to sectoral planning

CRS and CIAT used three separate tools and processes to support decision making in the development of these public policies. First, the collection of detailed household-level data through a rigorous baseline survey of smallholder coffee growers, which included both farmers participating in the Borderlands project and non-participants.

Second, facilitation of a participatory value chain analysis that involved key actors from the public, private, and non-profit sectors, and assessed the current state of the coffee sector in Nariño, identified key constraints and opportunities, and advanced recommendations to make the sector more competitive and inclusive. The key results of the baseline survey were shared as part of the participatory coffee sector planning process and contributed significantly to a clear and shared understanding of the current situation of coffee growers in Nariño.

Third, generation of up-to-date analysis of potential climate change impacts on the agriculture sector to support decision making on the farm and in the policy process.

The household-level baseline survey

Colombia's coffee institutions report that 39,423 families in the Department of Nariño are currently working 56,000 coffee farms covering about 39,000 ha.⁵ These findings suggest an average area of 0.7 ha per coffee farm, meaning that most coffee growers in this region are smallholders.

The Borderlands baseline survey was designed to complement these department-level data and deliver more precise figures for the eight municipalities in which the project is being implemented, namely, Buesaco, Chachagüi, El Tambo, La Florida, La Unión, Linares, Samaniego, and Taminango. According to the National Coffee Census of 2012, the total population of coffee growers in those eight municipalities was 14,414. Of these, 1,597 were project participants at the time the baseline was designed.

Interviews were conducted with 510 farmers for the baseline survey. Of these, 228 were participants in the Borderlands project and 282 were non-participants. The 110-question interview was divided into the following thematic sections: geographic location, family composition, connectivity, level of poverty, food security, farm characterization, non-coffee-based income and production, services, access to capital, coffee production system, coffee sales,

and division of labor. The data collected represented baseline values for key performance indicators that the project is tracking to measure its own progress, as well as data being mined in connection with the project's research agenda.

The baseline survey led to the identification of three distinct types of farmers growing coffee based on their main livelihood strategies. These were categorized as: (1) off-farm income earners: rural families that derive most of their income from off-farm activities, including non-agricultural activities; (2) diversified farmers whose income is generated through a range of agricultural activities including coffee growing; and (3) coffee specialists whose income is based primarily on coffee marketing.

The off-farm income group (32% of farmers) is made up of households whose main source of income comes from agricultural wages earned off the farm, non-agricultural income, self-owned businesses, public transfers, and remittances. For off-farm income households, 85% of income comes from non-coffee sources, making them less vulnerable to the income impacts of loss of coffee suitability due to climate change. This group has the smallest average farm size at 1.66 ha and the lowest income of the three groups.

The diversified coffee farmer group (51%) comprises households where most of the income comes from livestock production, agriculture, and coffee. Diversified coffee farmers derive 45% of their income from coffee and have a 53% chance of falling below the national poverty line. Farmers in this group are also the most exposed to climate change, with a 27% decline in the climatic suitability for coffee.

The coffee specialist group (17%) corresponds to households whose income derives mostly from coffee, with more than 65% of land devoted to the crop and more than 10 years of experience in coffee growing, and possessing their own processing plant (Vellema et al. 2015). The coffee specialist group has a 45% probability of falling below the national poverty line⁶ (Table 1). Coffee specialists are more exposed to fluctuations in the international price of coffee than other farmer types since they depend on coffee for 74% of their income, on average. However, this group also has the opportunity to take advantage of the farm's total area for climate adaptation as it possesses the largest average farm size at 2.32 ha.

The high rates of probability for farmers in each group falling below the poverty line (45–52%) suggest that the region's coffee sector is not effectively creating pathways out of poverty for smallholder farmers. Similarly disconcerting is the presence of food scarcity across all three groups. Baseline data collected on months of adequate household food provisioning (MAHFP) suggest very little difference on average across the three groups, with the highest average of months of food scarcity (2.05 for diversified farmers) differing relatively little from those of the other groups (2.02 for off-farm income and 1.85 for specialized coffee farmers).

See Table 1 below for a summary of key data points for each of these three farmer types.

5 Congreso Nacional de Cafeteros [National Coffee Growers Congress]. 2014. See <http://bit.ly/1KCZwFa>

6 According to the National Administrative Department of Statistics (DANE), in 2013, the percentage of poverty in Colombia was 30.6%. See <http://bit.ly/1NysohM>

Table 1. Summary of key data points from Borderlands baseline survey, by farmer type.

FARMER TYPE	PRODUCTION			INCOME + WELLBEING				CLIMATE CHANGE	
	Average farm size (ha)	Average area planted with coffee	Average production per farm (kg CPS)	Average % of income from:		Average income from coffee (US\$)	Probability of falling below poverty line		Months of adequate household food provisioning (MAHFP)
				Coffee	Non-coffee sources			% of farms likely to lose suitability for coffee production	
Off-farm income (32%)	1.66	0.63	227	15%	85%	654	51%	9.98	25%
Diversified farmers (51%)	2.32	0.97	763	45%	55%	2,415.11	53%	9.95	27%
Coffee specialists (17%)	1.96	1.66	1,503	74%	26%	5,130.43	45%	10.15	13%
AVERAGES	2.05	0.98	718	40%	60%	2,314.29	51%	9.99	24%

Note: These findings were used by Nariño's *Mesa de Café* (task force) as it worked from 2012–2013 to develop a competitiveness strategy for the region's coffee sector and continues to inform policy in Nariño vis-à-vis the coffee sector.

Participatory value chain analyses

In 2012, the GON convened the *Mesa de Café* (task force) a cross-sector working group charged with identifying and analyzing the strengths, weaknesses, opportunities, and threats in the region's coffee sector, and making concrete recommendations to make the sector more competitive. The *Mesa de Café* included delegates from: the Carcafé Foundation; Caritas Ipiales; Caritas Pasto; CRS; the Departmental Committee for Nariño of the National Coffee Growers Federation, GON, the Local Development Agency of Nariño (ADEL); Suyusama, and farmers organizations.

CIAT facilitated the work of the group using a methodology called Participatory Analysis of the Chain (Lundy et al., 2004, <http://bit.ly/1nwA9QE>), developed for multi-stakeholder processes. This process is summarized in Figure 1, column B. Through ten separate multi-stakeholder meetings over a period of 6 months, and with support from CRS and Borderlands project partners, CIAT helped the *Mesa de Café* generate the inputs for what would become the Nariño Coffee Value Chain Competitiveness Strategy.

This process of participatory analysis, involving multiple value-chain actors and other relevant stakeholders, led to deep alignment among participants around the identification of five principal weaknesses of the Nariño coffee chain:

1. Low productivity due to deficient production infrastructure, weak farm-level business management, poor adaptability of existing research to conditions of Nariño, and lack of management of climatic risks.
2. Inconsistent quality due to deficient production processes, lack of standardized processing procedures, limited financial incentives for quality from buyers, and the farmers' own confusion around what constitutes coffee quality.

3. Limited market contacts due to low segmentation of current coffee sales and a lack of information on existing and potential market channels.
4. Inadequate road infrastructure due to limited public resources and limited sectoral or citizen lobbying for appropriation of public resources for transportation infrastructure upgrades.
5. Weak farmers organizations due to lack of leadership skills, inadequate training and support schemes by local institutions and NGOs, outdated commercialization models, and little clarity as to what skills a competitive producers organization should have.

This process contributed to important outputs in the public-policy process.

The *Mesa de Café* developed the Nariño Coffee Value Chain Competitiveness Strategy to address these five limitations on the efficiency and inclusiveness of the Nariño coffee sector. That strategy was presented to leaders in the public sector, the private sector, non-profit organizations, and farmers associations, and embraced by the GON as a blueprint for the development of the region's coffee sector. It also informed the design and budget of the project "Strengthening the value chain for high-quality coffee in the Department of Nariño" (Figure 1, column A), approved by the General System of Royalties (SGR), which invests approximately US\$4.5 million (as of this writing) in public resources to operationalize the approach advanced by the Competitiveness Strategy. The collaborative work led by CIAT, specifically the cross-sector alignment on the measures proposed in the coffee sector competitiveness plan, contributed to the approval of the proposal. The project is being implemented by a consortium of local organizations in Nariño under the leadership of CRS, including ADEL, Caritas Ipiales, Caritas Pasto, Cornell University, FNC, GON, Suyusama, and Universidad de Nariño.

Furthermore, the actors convened by the *Mesa de Café* contributed on the basis of the insights generated through this process to the development of a public policy approved by the Ministry of Agriculture and Rural Development (MADR) and the Presidency of the Republic. This policy document, known as CONPES 3811, was generated by the National Council for Economic and Social Policy (CONPES) for the development of the agriculture and livestock sectors in Nariño, and includes investment in the coffee sector that builds on the technical and scientific evidence incorporated into the process in Nariño through the CIAT-CRS partnership.

CONPES 3811 calls for investments over a five-year period of US\$739 million from the budget of the Government of Colombia, \$47 million by the GON, and more than \$163 million from the SGR, the federal government's program for collecting and redistributing receipts from concessions in the energy sector. The SGR resources will be invested in the creation of credit facilities for rural capitalization, road infrastructure, irrigation systems, and food security.

Modeling impacts of climate change

CIAT researchers combined global climate models with digital elevation maps and crop models to generate models of climatic suitability⁷ for coffee, cassava, beans, maize, plantain, and sugarcane for the years 2020 and 2050. The five non-coffee crops were selected by the *Mesa de Café* because of their importance to local food security. The modeling was carried out under a "business-as-usual" scenario under which no greenhouse gas emissions mitigation measures are taken. This modeling was also undertaken for a scenario with no adaptation. Climatic suitability for a given crop was estimated by using an algorithm for modeling potential species distributions (MaxEnt), recorded with geographic coordinates that indicated sites carrying the crops (coordinate

references taken from the project's baseline) and environmental variables of the study area.

The model found that most farms had a level of climatic suitability of more than 50% for coffee by 2050 (Figure 2), which is positive in that it shows that the farms had more than a 50% favorability for coffee production in environmental terms. The modeling for 2050 showed that the potential area of climatic suitability for coffee would rise in altitude to as much as 2500 meters above sea level (masl), with the appearance of new suitable zones through increases in temperatures.

Despite the possible gains in high-elevation zones (>2100 masl), net loss of area for 2050 could be a little more than 50%, as observed in Figure 3. This would affect almost 25% of current coffee farms in the department. This is equivalent to about 10,000 of the more than 40,000 coffee growers who live in the area, according to the 2013 National Coffee Growers Congress.

The group of diversified coffee farmers (Table 1) may suffer the highest loss of climatic suitability for coffee production with a 27% reduction. However, this group may also have the most capacity to respond when adapting to climate change because they possess the largest farms and are less exposed to coffee suitability reductions since roughly 50% of their incomes come from non-coffee production activities. The coffee-specialist group may suffer the least loss of suitable area (only 13%), compared with the other groups (Table 1). Increases in suitable cropping areas are also projected for the five crops grown in association (and important for food security in the coffee-growing region). Sugarcane and maize would each gain an extra 20% or more in suitability, while cassava would gain 33% or more. Plantain and beans both maintain present suitability levels, with potential increases of less than 5% each (Figure 3).

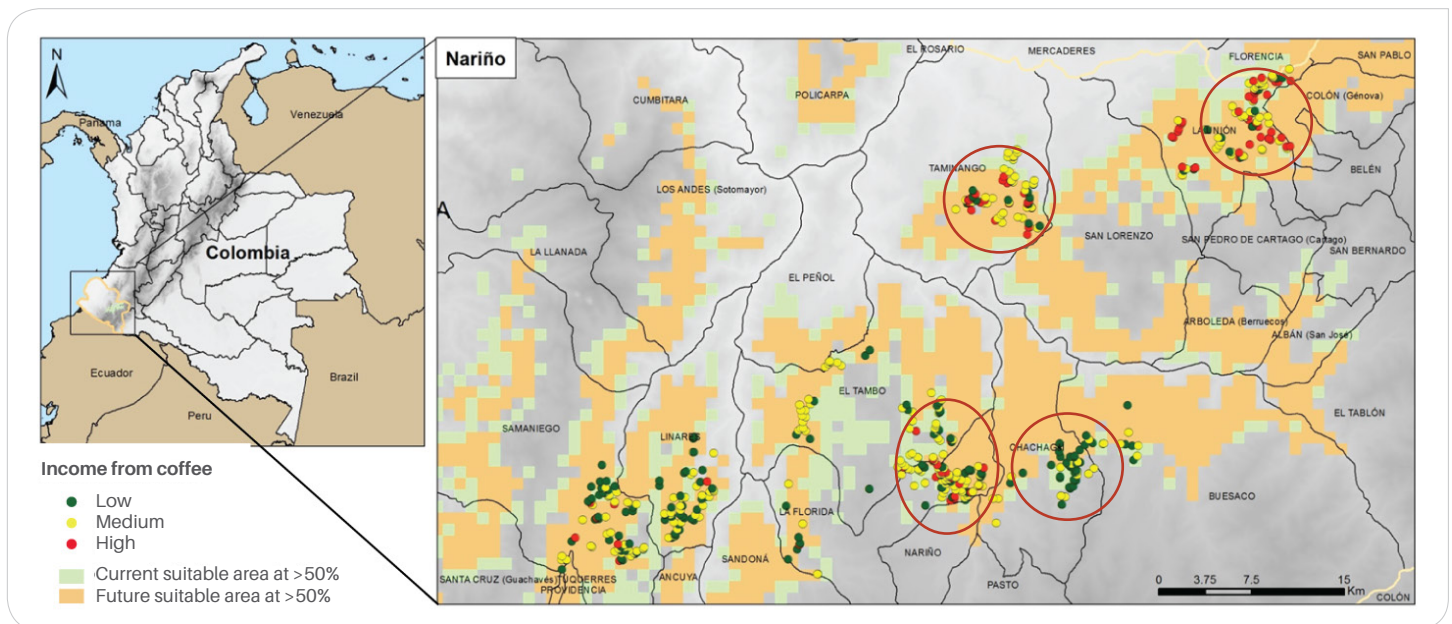


Figure 2. Map of losses and gains in climatic suitability for coffee. Red circles indicate farms with diversified incomes and for which loss of climatic suitability is estimated at 27%.

7 A climatic suitability model shows a suitability index (between 0 and 100) for a given crop under the specific climatic conditions of a given study site.

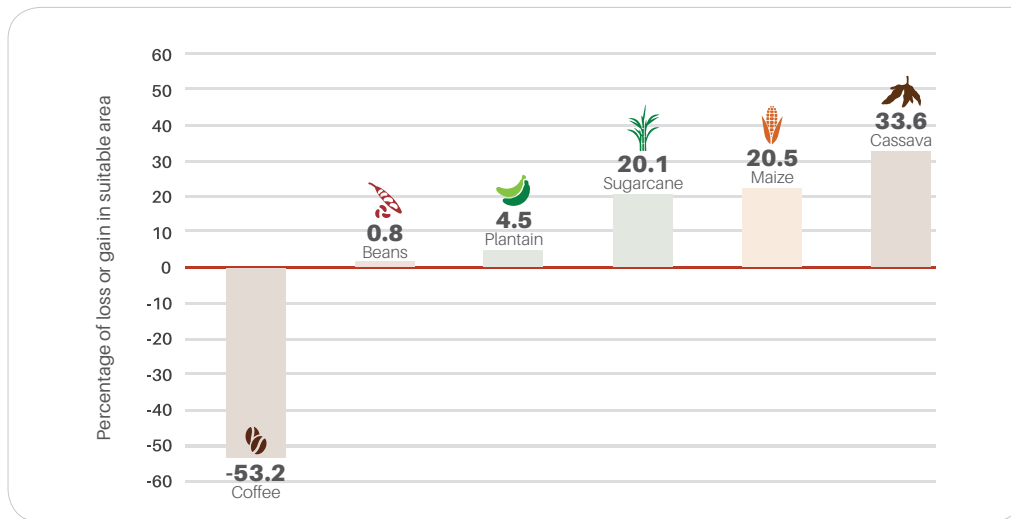


Figure 3. Percentage of loss or gain in suitable area for coffee and its crops in association, Department of Nariño, Colombia.

Recommendations for improvements in public policies for the coffee sector

The process described in this brief is worthy of careful consideration among research institutes and development agencies and may show a new way forward for collaboration to achieve influence at scale and contribute to improved, more inclusive public sector policies, and spending priorities.

Intent to influence: Scientific and technical information for decision support

The process described above was part of an intentional effort by CRS and CIAT to support and influence decision making on the farm, in the policy-making process, and in the marketplace through the generation and delivery of result-based evidence to key coffee sector stakeholders. The Borderlands Coffee Project’s “research-for-influence” agenda was designed to enlist technical and scientific evidence in the promotion of more inclusive practices and policies at each of the levels mentioned above. The project’s success in exerting influence over public policy and spending priorities for Nariño’s coffee sector broadened the project’s reach from the 1,600 smallholder farming families who participate in the project directly to affect the entire population of coffee growers in Nariño, who number around 40,000. At a time of dwindling investment in development programming, pairing field-based operations with “research-for-influence” partnerships could position development agencies to contribute to broad-based impact even at a time of declining investment in the sector.

A-B-C-D-E-F: Able, credible, disinterested and evidence-based facilitation

The success of the process described here was driven by the fact that its facilitation was perceived by key stakeholders as being: *able* – possessing the skills necessary to effectively facilitate constructive cross-sector engagement; *credible* – perceived as having expertise and substantive understanding of the content on which the process focused; *disinterested* – lacking any financial or vested institutional interest in any particular outcome besides a clear commitment to inclusion; and *evidence-based* – driven by technical and scientific findings generated through rigorous and participatory processes.

Farmer typologies: Customized approaches for different kinds of farmers

The Borderlands project team identified three discrete farmer typologies through the project’s baseline survey and analysis – specialized coffee farmers, diversified farmers who grow coffee, and rural dwellers who rely primarily on off-farm activities for income generation but also grow coffee. Each of these groups allocates resources – labor, time, and inputs – differently across a range of activities, with different levels of efficiency in each of those activities, including coffee farming. Public policies aiming at poverty reduction in the coffee sector should reflect the differences between farmer types in their efforts to maximize net income of farmers in the coffee sector. Effective interventions will be adapted to the conditions of each farmer group.

Climate change adaptation: Suitability and sustainability

The Borderlands project team identified “winner” and “loser” crops – agricultural products that gain and lose suitability over time under likely climate change scenarios. Effective adaptation strategies for smallholder farmers currently growing coffee will take these crop-specific projections into account.

Staple crops including beans and plantain may continue to have the same degree of climatic suitability as they do now in coffee-growing regions, making continued cultivation of these high-nutrient crops viable in the study area.

Sugarcane may increase in suitability in the coffee-growing areas covered by the study, creating the possibility of an increase in the supply of products such as *panela* – a shelf-stable processed sweetener obtained from sugarcane through a light industrial process. To fully capitalize on increased production of sugarcane, improvements to *panela*-processing infrastructure and a comprehensive marketing strategy should be developed and directed primarily at consumers in Nariño and markets in neighboring departments.

Maize may gain more suitability in the coffee-growing region and could help to smooth family income if it is planned for harvest or stored for sale during seasons when prices are more stable and

products are better remunerated. Cassava may also gain more suitability, thus improving access to this carbohydrate-rich food crop.

Studies involving simulations of climate change and rigorous soil mapping in zones that will suffer significant reductions of suitability for coffee can be crossed with information from studies of national and international markets to identify crops in the current coffee-growing region of southern Colombia that combine agronomic suitability and market opportunity.

In all scenarios involving changes in land-use patterns, careful consideration must be given to ecological impacts, especially in the case of transition away from shade-grown coffee to annual or short-cycle crops grown in full exposure to the sun, and in the case of any crops planted on steep hillsides. Soil degradation, soil erosion, loss of soil organic matter, loss of soil fertility, reduction of greenwater resources and sedimentation of bluewater resources are all likely negative effects of such transitions, especially in the absence of explicit soil and water conservation and management efforts.⁸

Smarter agronomic extension and programming: Agroecological suitability for quality-based differentiation

Environmental or agroecological variables were shown to be critical determinants of the suitability of a particular farm for coffee production. They are also important determinants of a farm's ability to produce coffee with the specific sensory or organoleptic attributes sought in high-value segments of the coffee market. The identification of distinct agroecological or environmental niches with different levels of suitability for quality-based differentiation would position public-sector service providers for more "intelligent"

8 <http://bit.ly/1nlapAP>

Additional reading

- CONPES (Consejo Nacional de Política Económica y Social). 2014. CONPES 3811: Políticas y estrategias para el desarrollo agropecuario del Departamento de Nariño. CONPES del Departamento Nacional de Planeación, Bogotá, DC, Colombia. Available at <http://bit.ly/1nwOKeR>
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- Eitzinger A; Carmona S; Pérez JG; Läderach P. 2015. Evaluación del cambio climático en café y cultivos asociados para principales regiones cafeteras de Nariño. Internal report. Borderlands Coffee, a CRS–CIAT Project, Cali, Colombia.
- Oberthür T et al. 2011. Regional relationships between inherent coffee quality and growing environment for denomination of origin labels in Nariño and Cauca, Colombia. *Food Policy* 36:783–794.
- Rodríguez-Camayo F; Schuit P; Lundy M. 2013. Análisis participativo de la cadena de café en Nariño, Colombia. Internal report. Borderlands Coffee Project, Cali, Colombia.
- Vellema W; Buritica A; González C; D'Haese M. 2015. Coffee matters: livelihood strategies of specialty coffee producers. *Food Policy*.

approaches to agronomic extension and programming in the coffee sector.

Environmental niches need to be identified and joined with specialty marketing niches, taking advantage of the "denomination of origin" and the international market's recognition of Nariño's high-quality coffee, while seeking the maximum expression in the cup-of-coffee profile with respect to the relationship between variety + environmental offer + postharvest handling + markets.

This could be achieved by designing geographic maps that show specific information (demography, environment, technical infrastructure, and socioeconomics) for each of the department's regions. The maps could also show segmentation of supplies of available coffees (cup profiles) and identify pilot processing plants that benefit the coffee community by increasing incomes through permitting (in theory) economies of scale in postharvest handling and quality control. However, a monitoring and evaluation study of the process must also be carried out to discover the viability of such plants over the medium and long term. In zones where the potential for high differentiation is not promising, but are agronomically still viable for cultivating coffee over the medium term, focus must be given to high productivity + farm diversification to maintain a balance between coffee and non-coffee incomes.

It is also essential to generate local capacities focused on achieving high quality in aspects such as postharvesting, ideal fermentation times according to geographic location, drying infrastructure, and storage. This could be catalyzed by implementing more inclusive business models that facilitate communication with the private sector, both for high-quality and mass-produced coffees, as is done for other sectors such as fruits and vegetables.

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