Title

Assessment Report: Benchmarking Sustainability for Banana Production in Ecuador

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Contents

Executive Summary

The University of California Davis (UC Davis) has been collaborating with diverse members of the Ecuadorian banana industry and other partners in conducting a sustainability assessment for banana production in Ecuador. The overarching goal of this assessment is to aid the Ecuadorian banana industry in improving its sustainability footprint for the entire industry—at a national level. The starting point for improving system-wide sustainability was to conduct a baseline assessment of the current sustainability situation to identify and measure a suite of indicators for use as a benchmark in both guiding strategies and measuring progress. This assessment was designed to review the state of the banana sector and correlated activities *within Ecuador* and not function as a comparative assessment against other countries or actors – which would require a similar assessment for each actor.

Guidelines for the baseline assessment to be strong and considered as legitimate by all included being:

- Conducted by a respected neutral party (UC Davis)
- An engagement with diverse partners from industry, government, and civil society to determine WHICH challenges will be included in the assessment, and HOW they will be measured.

Priority topics identified through the stakeholder engagement (broadly) include:

- Environmental footprint of the industry, including land and water impacts, and chemical use
- Labor / worker wages and safety, and impacts on the community
- Economic policy (including global markets)
- Risk factors, including climate change and TR4 virus

The assessment deliberately includes analyses of both impacts of banana production on sustainability and vulnerabilities to the sustainability of the production system as different yet essential perspectives for long term health and sustainability of the sector. The assessment process, itself, included stakeholder engagement elements as noted, identification of indicators and datasets for use in analysis, and identification of data gaps. The team added on a survey of banana farms to fill some of the critical data gaps.

The selected indicators in the assessment cover a broad range of issues, which both give context around which the industry operates, and are also impacted by banana production. Starting at the macro level, for Ecuador, the social story is largely positive. Over the last 10 years, the country has made solid strides in the right direction on virtually all of the human wellbeing topics --- life expectancy is increasing, childhood nutrition indicators are improving, wages are increasing and poverty is decreasing, child labor rates in the banana sector and more broadly have been drastically reduced (even if not yet at zero as desired), and literacy rates are high. While poverty is still a major challenge across the country and the region, there have been significant improvements during this period and the direction remains positive. That reflects the country as a whole. We also focus on a subset of these indicators to see how they may vary in banana production communities. Generally, progress is moving faster in the lowlands areas where bananas are produced than other parts of the country—suggesting that the sector is having

positive impacts, or at least *not* having significant negative impacts. Demographics at this finer scale are important to examine, as broad urbanization trends are changing rural communities more quickly in some provinces and cantons than others, with some banana producing cantons projected to begin losing population in the next decade. Banana producers may need to think creatively about human resources in the coming period. For example, technical innovation is opening new windows and women have lower representation across the agricultural work force, which may provide untapped resources to consider in the future. The key challenges in this social sphere focus around keeping communities strong and the work force intact. The diversity of the sector can also be a strength in this sphere, as small, medium, and large farm operations are all strong – and individual innovators are present at all scales.

Regarding environmental issues, priority vulnerabilities stem from both climate effects such as increased climate variability, potential flooding, and potential loss of growing areas from sea level rise, and potential pathogens, such as *Fusarium oxysporum* (Foc R4T), which has a high probability of getting into Ecuador in the near term, based on its 2019 arrival in Colombia. Water supplies and infrastructure are stable and less of a priority, although contamination of freshwater systems from agricultural chemicals remain a concern. The predominant monoculture pattern of current banana production, and the high dependency of the industry on agricultural chemicals, with their negative impacts, represents a vulnerability. Interestingly--both vulnerability and impact concerns can also provide a tremendous opportunity, as there is ample room for both innovation and increased efficiencies in these areas. However, embedded in this opportunity is overcoming the challenge of low investment in research and innovation in the banana sector. For example multiple sources indicate that the industry has been using the same cultivars for decades, and, while there are individuals growers and others focused on innovation within the industry, there is no strong research program in operation anywhere in the world successfully developing commercial banana varieties resistant to new pathogens, or focused on improving production efficiencies in a systematic way.

Further, best practice suggestions for on-farm carbon management and integrated pest management are inconsistent in Ecuador, and in some instances, also impeded by regulatory structures. For example: adoption of some recommended practices, such as composting organic material back into the soil, is fairly common across conventional production systems, whereas crop rotation is largely viewed as unfeasible under current production practice and regulatory frameworks, and the adoption of integrated pest management approaches are common on organic farms, yet limited and hard to measure for conventional systems. Ecuador is beginning to transition from fossil-fuel base energy sources into cleaner electric energy options to power operations, but that transition is in early stages.

Overall, the industry remains economically healthy, and the product is well valued and important worldwide. Yet there are incremental and potentially systemic improvements that can be made to improve the sustainability of the system. The recent development of a cooperative industry group/banana cluster in Ecuador and investment in this assessment and other initiatives are strong signals that the banana sector is ready to move forward to improve sustainability of the industry.

Background

Since the launch of our Global Sustainable Sourcing Initiative in 2011, our research group at UC Davis has worked to develop a comprehensive understanding of food system sustainability and to develop tools and methodologies that can organize this complex network of linked food system relationships into a simplified, yet still rich format for measuring sustainability in specific settings. The idea is that a broad understanding of sustainability can be constant for all commodities in all locations, but the salient issues and specific indicators that one would use to measure sustainability remain situation dependent. An entire research program: "Food System Informatics", has since developed out of this approach.

Our operational principles include a focus on:

1. Practicing Sustainability: We strive to enact sustainability principles and practices in our own activities.
2. Legitimacy: We set our priorities and design our programs in response to concerns and aspirations of stakeholders representing the diversity of our research areas.
3. Usefulness: Responsiveness to stakeholders' needs -- the broad interest of society as well as needs of specific groups -- is key to the relevance of our initiatives and provides the necessary focus on real issues and opportunities.
4. Credibility: We hold ourselves to the highest standards of professional integrity and scientific vigor.

This assessment report synthesizes a broad understanding of sustainability with available data to provide a benchmark of key indicators for understanding the current sustainability situation and measuring future progress for the banana industry in Ecuador. The assessment team also completed a detailed survey of over 470 banana producers in December 2019 to augment data from national and international sources, partnering with local researchers to conduct the fieldwork.

Our methodology enables identification of both salient issues and a set of measurable indicators that together enable a comprehensive understanding of sustainability for specific situations. As food production is always linked to the location, geospatial analysis of key indicators at the landscape level is a critical component for understanding sustainability attributes of the system. A discussed intention is to use the benchmarked information in this report to help establish an ongoing banana sustainability protocol for Ecuadorian banana production, and for use in measuring progress over time.

Stakeholder process and Issue identification

For this assessment, the UC Davis team worked in close collaboration with a project advisory committee comprised of banana farmers of various scales, exporters, input providers, and academic partners to help guide the usefulness of the assessment. An expanded set of diverse stakeholders from industry,

government, and civil society was additionally consulted to identify the most salient sustainability issues related to banana production in Ecuador and highlight topics that would be desirable to benchmark.

The issue identification process included:

- Interviews with broad selection of stakeholders (including steering committee members)
- Site visits to different types of banana farms
- Site visits to related industry sites / partners
- Deep literature review of material from scientific, industry, advocacy, and news sources

A visual representation of the stakeholders that were consulted is presented in the figure below:

Assessment framing

We use two general organizing frameworks: Impact and Vulnerability and four capital groups to organize how sustainability is measured in the study. Guiding questions for the two frameworks are:

- Impact Framework: Is it likely that banana production in Ecuador will have significant, direct impacts on this issue?

  Example for the issue of climate change: How does banana production contribute to GHG emissions?

- Vulnerability framework: Does the banana sector face significant, direct exposure/sensitivity to this issue?

Example for the issue of climate change: In what ways is banana production in Ecuador exposed/sensitive to climate change?

The two frameworks are both critically important for the assessment, and often require different types of indicators to provide useful information on similar topics from the two perspectives. Certification programs and the global marketplace largely look for indicators measuring the impact of the production system on people and the environment, whereas decision-making regarding the long-term vitality of the system requires looking at vulnerabilities to the system. Both perspectives are important for understanding and improving sustainability.

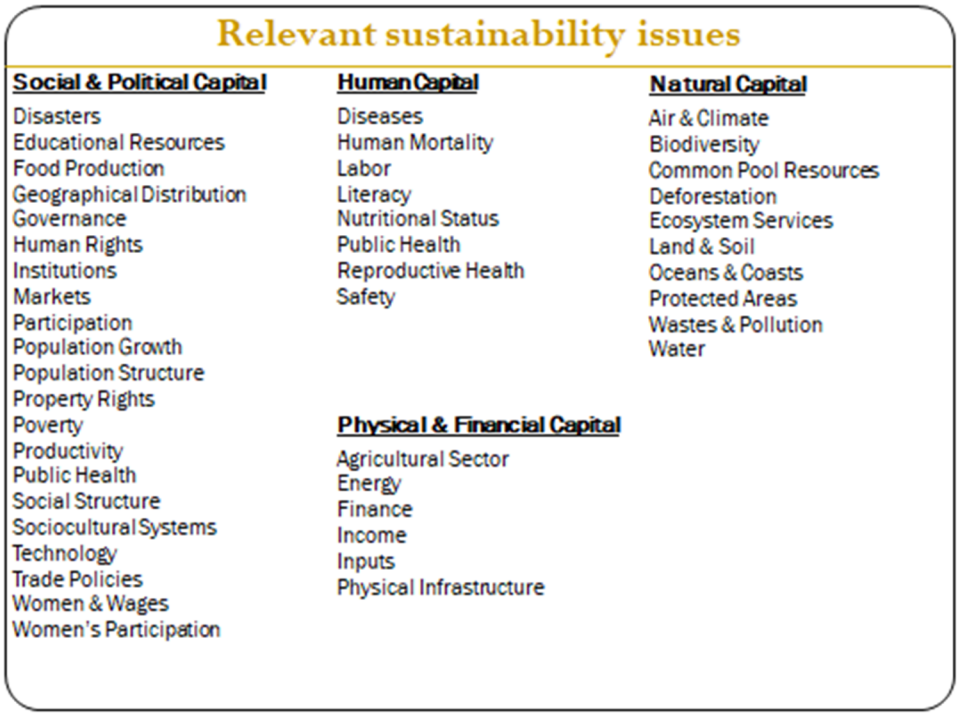
We divide types of indicators into four common capital groups, to help organize and guide measurement:

1. Human Capital: Human capital includes skills, knowledge, ability to labor, and good health that enable people to achieve their livelihood objectives.
2. Social & Political Capital: Social capital includes: 1) networks that build trust and cooperation, including political and civic institutions; 2) membership in groups with rules, norms, and sanctions; and 3) relationships of trust, reciprocity, and exchange. Political includes resources that are key to rights over assets, including: power relations; citizenship; enfranchisement; and membership in political parties.
3. Physical & Financial Capital: Physical capital includes basic infrastructure and producer goods. Consists of changes to the physical environment such as affordable transport, secure shelter and buildings, adequate water supply and sanitation. Financial capital are resources that support livelihood objectives.
4. Natural Capital: Natural resource stocks; public goods (e.g., biodiversity); assets used for production (e.g., land, trees).

(Adapted from Adato, M. and R. Meinzen-Dick, 2002).

Human capital topics are often measured at the level of the individual, for example per capita ratios or incidence rates for a population. Social and political capital topics are collective or community measures, including societal trends, policies, and governing structures. Physical and Financial capital topics are generally measured as a monetized value. And natural capital topics are more often measured at a landscape level related to resource stocks or geographic characteristics.

The issues that were identified as being relevant to banana production in Ecuador span the full breadth of sustainability issues included in our comprehensive understanding of sustainability:



Priority topics identified through the stakeholder process (broadly) include:

- Environmental footprint of the industry, including land and water impacts, chemical use (IMPACT framework)
- Labor / worker wages and safety, and also impacts on the community (IMPACT framework)
- Economic policy (+ global markets) (IMPACT + VULNERABILITY frameworks)
- Risk factors, including Climate change and TR4 virus (VULNERABILITY framework)

Selected indicators to use for benchmarking sustainability -- organized by capital group

SDI: Comparable UN Sustainable Development Goal Indicators / 2020 Indicator Framework:
https://unstats.un.org/sdgs/indicators/Global%20Indicator%20Framework%20after%202020%20review_Eng.pdf

Human capital

Indicator	Capital	Indicator / indicator set	Framework	Page
H1 (SDI: 3.8.1)	Human	Access To Primary Health Care Facilities (set)	Vulnerability	16
H2 (SDI: 4.6.1)	Human	Adult Literacy	Vulnerability	18

H3 (SDI: 8.7.1)	Human	Child labor	Impact	18
H4 (SDI: 4.3.1)	Human	Educational enrollment	Vulnerability	21
H5	Human	Life Expectancy At Birth	Vulnerability	22
H6 (SDI: 3.1.2, 3.2.1,	Human	Maternal and child health (set)	Both	22
H7 (SDI: 8.8.1)	Human	Occupational Injury	Impact	23
H8	Human	Pesticide exposure in workers	Impact	25
H9 (SDI 2.1.1; 2.2.2)	Human	Undernutrition/Overnutrition (set)	Both	27

Social and Political capital

Indicator	Capital	Indicator / indicator set	Framework	Page
S1-S2	Social and Political	Agricultural workforce - total and % of population	Impact	28
S3	Social and Political	Agricultural workforce - gender ratio	Impact	29
S4	Social and Political	Agricultural workforce – age distribution	Both	30
S5	Social and Political	Corruption Index	Vulnerability	31
S6	Social and Political	Crime: Drug trafficking - cocaine (set)	Vulnerability	32
S7 (SDI: 2.4.1, 7.1.2)	Social and Political	Cultivation and processing practices (set)	Impact	33
S8 (SDI: 5.b.1)	Social and Political	Digital access	Vulnerability	35

S9	Social and Political	Business Climate 1: Ease of Doing Business Index - overall score	Vulnerability	36
S10	Social and Political	Business Climate 2: Ease of Doing Business Index - Registering property	Vulnerability	36
S11	Social and Political	Business Climate 3: Ease of Doing Business Index - Paying taxes	Vulnerability	36
S12	Social and Political	Business Climate 4: Ease of Doing Business Index - Credit access	Vulnerability	36
S13	Social and Political	Business Climate 5: Ease of Doing Business Index - contract enforcement	Vulnerability	36
S14	Social and Political	Inequality / Gini Index	Vulnerability	37
S15 (SDI: 5.5.2)	Social and Political	Labor force participation	Impact	38
S16	Social and Political	Labor inspection	Vulnerability	39
S17 (SDI: 5.a.2)	Social and Political	Land tenure & size of farms	Impact	40
S18 (SDI: 11.3.1)	Social and Political	Population (set)	Vulnerability	41
S19 (SDI 1.1.1)	Social and Political	Poverty (set) / MDP	Both	42
S20 (SDI 1.2.1; 1.2.2)	Social and Political	Poverty (set) / NBI	Both	42
S21	Social and Political	Quantity Of Training & Further Education Of Workers	Both	50
S22 (SDI: 8.8.2)	Social and Political	Right To Start & Form Trade Unions, Bargain Collectively	Both	50

Physical and Financial capital

Indicator	*Capital*	*Indicator / indicator set*	*Framework*	*Page*
P1	Physical and Financial	Gender Wage Gap	Both	**51**
P2 (SDI: 8.10.2, 9.3.2)	Physical and Financial	Access to capital (set)	Vulnerability	**52**
P3 (SDI: 9.5.1)	Physical and Financial	Investment in R&D	Both	**53**
P4	Physical and Financial	Patent applications	Both	**55**
P5	Physical and Financial	Price	Both	**55**
P6	Physical and Financial	Quality of port infrastructure	Vulnerability	**56**
78	Physical and Financial	Container port traffic	Both	**56**
P8	Physical and Financial	Total Tax Rate (% Of Commercial Profits)	Vulnerability	**57**
P9	Physical and Financial	Use Of Agricultural Pesticides	Impact	**57**
P10 (SDI: 8.5.1)	Physical and Financial	Workers/Smallholders Earn Minimum Wage	Impact	**58**

Natural capital

Indicator	Capital	Indicator / indicator set	Framework	Page
N1 (SDI: 6.4.2)	Natural	Water availability	Vulnerability	**59**
N2	Natural	Damage Due To Diseases	Vulnerability	**62**

N3 (SDI: 15.1.2, 15.3.1)	Natural	Decline In Species & Habitat Diversity	Both	**62**
N4 (SDI: 13.2.2)	Natural	Emissions Of Greenhouse Gases	Both	**65**
N5 (SDI: 1.5.2, 11.5.1, 11.5.2)	Natural	Extreme Climate Events (Floods & Droughts)	Vulnerability	**66**
N6 (SDI: 15.1.1, 15.3.1)	Natural	Fragmentation Of Habitats	Impact	**69**
N7	Natural	Global Mean Temperature Rise	Both	**70**
N8	Natural	Harvest Of Wood Products	Impact	**62**
N9 (SDI: 1.5.2, 11.5.1, 11.5.2)	Natural	Land Area Where Elevation Is Below 5 Meters	Vulnerability	**71**
N10	Natural	Offtake Of Given Species	Vulnerability	**62**
N11 (SDI: 12.5.1)	Natural	Waste Recycling & Reuse	Impact	**73**
N12 (SDI: 6.4.2)	Natural	Water Availability, Trend, & Uses	Both	**66**
N13 (SDI: 6.3.2)	Natural	Water Quality - Evidence Of Pollutants	Impact	**74**
N14 (SDI: 6.3.2)	Natural	Water Quality: Nutrients	Impact	**74**

Assessment scope

The scope of the assessment is the banana production and packing process for raw fruit, up to the point of departure from the country for the commercial export market. Local consumption and processed products are not included in the assessment.

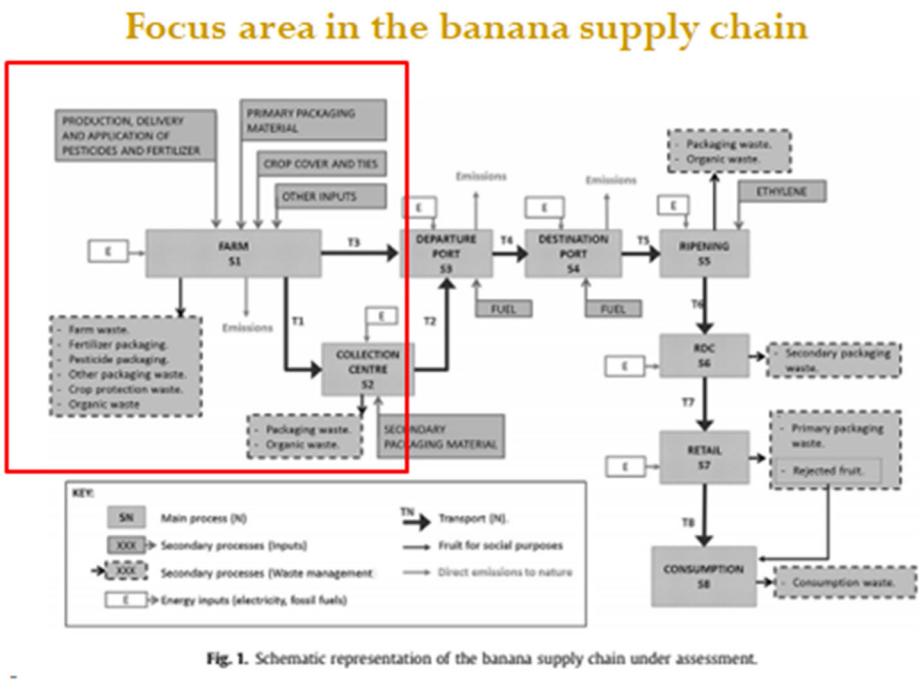


Fig. 1. Schematic representation of the banana supply chain under assessment.

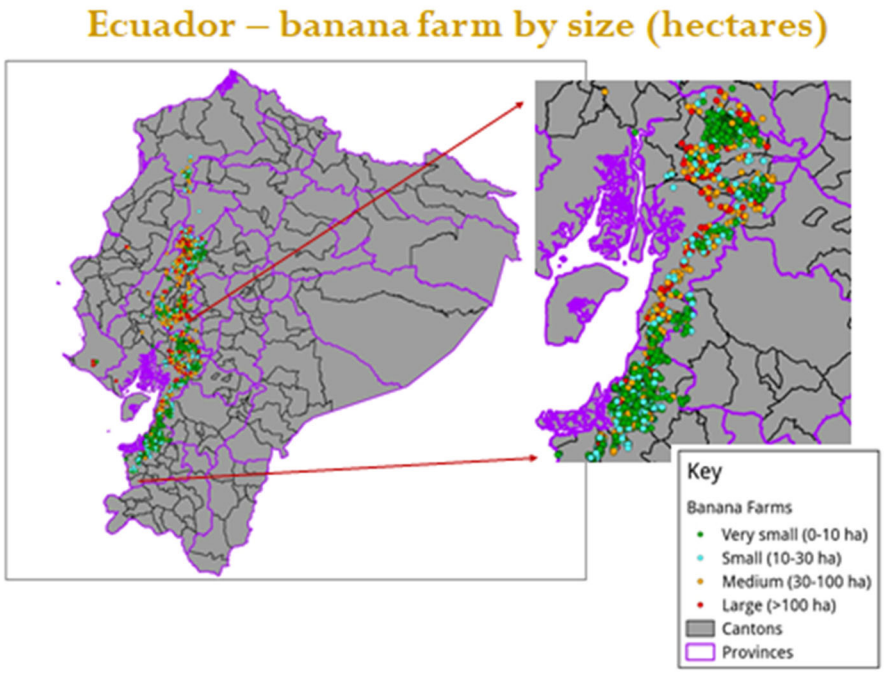
Roisbas et al. 2016

Banana farms profile

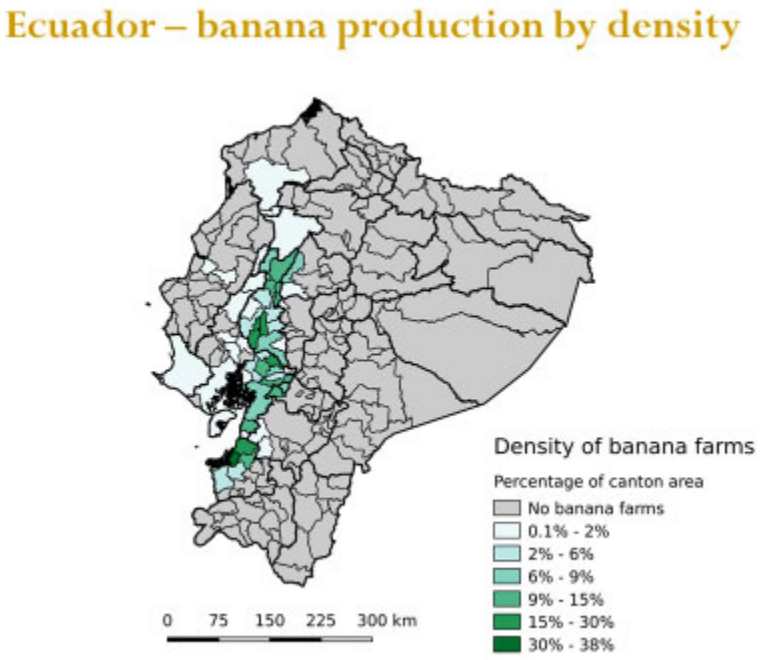
The study uses detailed 2017 banana farm registry datasets received from the Ministry of Agriculture for farm profile and location information. This registry gives detailed information (at the GPS coordinate level) for 5,690 banana producing farms representing 162,521 hectares of production, with an average farm size of 29 hectares. 2019 registry information is also available, but not at the spatial scale needed, thus the **2017 detailed registry (Catastro Bananero) is the baseline farm registry used for the assessment, and should be used for comparison going forward**. It should be noted that banana farms in Ecuador are required to be registered with the Ministry of Agriculture and that there is a general moratorium on development of banana production on new land areas, with a few exceptions (mainly for new organic farms). Most banana farms have been in production for decades, so the spatial location of production sites is very stable, and a two year difference is not significant for this analysis.

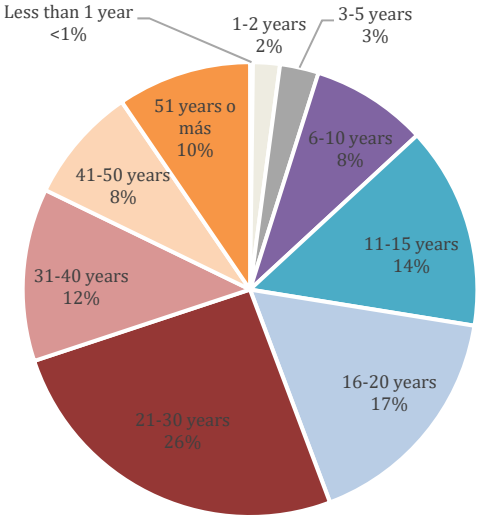
2017 registered banana farms, by size:

- Small farms (<30 hectares): 4,274 farms / 35,683 hectares
    - 75% of total number of farms
    - 22% of farm area
- Medium farm (30>100 hectares): 1,082 farms / 58,620 hectares
    - 19% of total number of farms
    - 36% of farm area
- Large farms (100 ha or more): 334 farms / 68,217 hectares
    - 6% of total number of farms
    - 42% of farm area

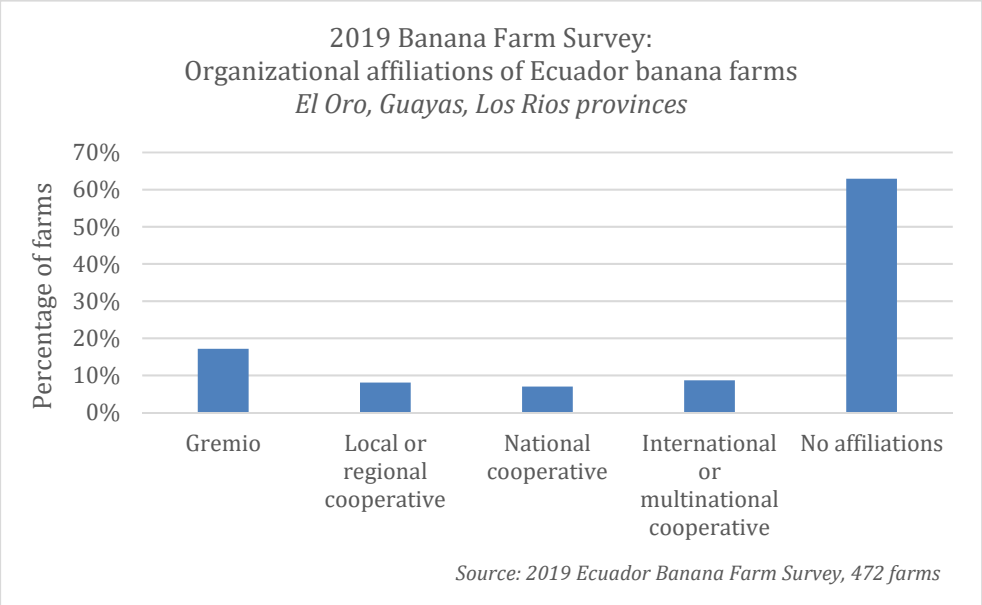


Registered farms are located in 11 provinces (Azuay, Bolívar, Cañar, Cotopaxi, El Oro, Esmeraldas, Guayas, Los Ríos, Manabí, Santa Elena, Santo Domingo de los Tsáchilas), residing in 49 cantons and 101 parroquia. The majority of banana farms, however, are located in 3 key provinces: El Oro, Guayas, and Los Rios. Issue analyses focused specifically on banana production areas where possible. Canton, province, national, and geographic scales of analysis were used, depending on availability and appropriateness of data for each issue. (No analyses were done at the parroquia scale.)





Source: 2019 Banana Farm Survey, 472 farms



The **Banana Farm Survey completed in December 2019** ("Encuesta Ecuador Bananero 2019") was added to this assessment process to augment existing data sources. The survey was designed to collect information about banana farm production and management practices from a random selection of farms distributed evenly across the three primary production provinces: El Oro, Guayas, and Los Rios, and distributed across the 4 categories of farm size as noted: very small (0-9 ha), Small (10-29 ha), Medium (30-99 ha), Large (100+ ha). Note: The assessment divides the "small" category used by the ministry banana registry (0 to 29 ha) into two categories: "very small" and "small" to provide more information on this large group of farms and identify potential differences in management practices within the broader category.

UC Davis partnered with a local research team led by Drs. Isabel Cartagena and Sol Faytong to conduct field interviews. The survey team successfully interviewed managers or owners of 472 banana farms, achieving a very good distribution across the noted provinces and farm size categories, and also across the banana production cantons in each province. (Province distribution of survey: El Oro – 32%, Guayas – 35%, Los Rios – 33%; Size distribution: Very small farms – 21%, Small – 22%, Medium – 33%, and Large – 25%). Specific results of the survey are included in the assessment outputs that follow, as they correlate with focus indicators or topics. It is noteworthy that this is a larger and much better randomized sample size than we have seen used in any recent literature about banana production in Ecuador or elsewhere.

ASSESSMENT RESULTS: HUMAN CAPITAL INDICATORS

H1. Human Capital – Health Care Access

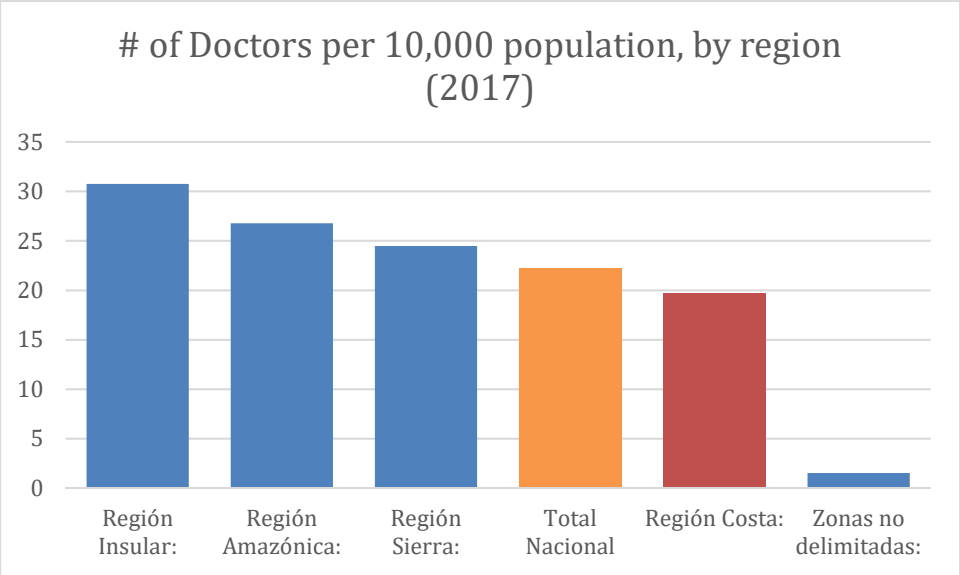
Indicator	Scope	Value	Data Source
Physicians (per 1,000 people)	Ecuador/national	2.2 (2017)	INEC
% Banana farms providing additional healthcare benefits to employees	Ecuador/El Oro, Guayas, Los Rios provinces	Rate: 70% of surveyed farms	2019 Banana Farmer Survey
% Banana farms providing on-site healthcare	Ecuador/El Oro, Guayas, Los Rios provinces	Rate: 8% of surveyed farms	2019 Banana Farmer Survey

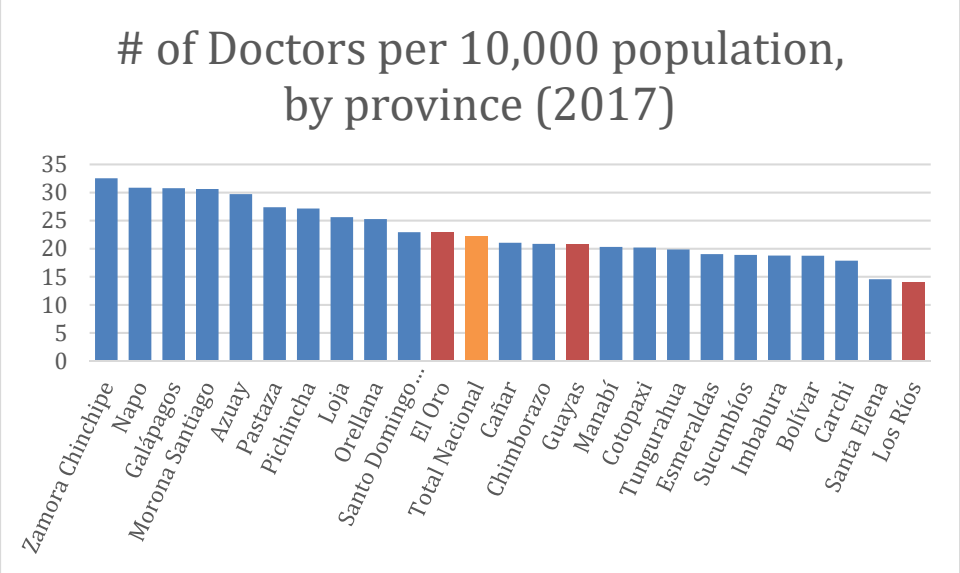
Source: https://www.ecuadorencifras.gob.ec/actividades-y-recursos-de-salud/
These rates are internationally comparable.

Discussion: Free access to public healthcare is guaranteed in Ecuador. There are a variety of both public and private facilities providing healthcare, and regional differences in types and density of providers exist. For two of the three most important banana growing provinces, El Oro and Guayas, health care provider rates are near the national average. The province of Los Rios, however, has a lower rate. And the broader coastal region, which includes all 3 key banana production provinces and several minor production provinces, is the region with the lowest density of doctors per capita in the country. For context: the US has a physician rate of 2.6 physicians per 1,000 inhabitants and has medical shortages in some regions. Europe has rates around 5 per 1,000. Cuba is over 8 physicians per 1,000 inhabitants. (Note: International rates refer to physicians per 1,000 population. Ecuador uses physicians per 10,000 population in its national data – so Ecuador-sourced data will be one decimal place different.)

Ecuador currently has a relatively young and healthy population. We can expect physicians to become in higher demand as the population ages. At this point, banana production occurs in regions with slightly lower access to physicians, and there are multiple comments from the 2019 farmer survey noting challenges accessing health care through social security. The 2019 survey also notes that seventy percent (70%) of surveyed banana farms offer additional employee healthcare benefits, and eight percent (8%) provide employee and sometimes family access to on-site health care professionals.

Healthcare access is a general vulnerability that will serve as a useful to benchmark and monitor going forward.





Source: https://www.ecuadorencifras.gob.ec/actividades-y-recursos-de-salud/

H2. Human Capital – Adult literacy

Indicator	Scope	Value	Data Source
Adult literacy rate, population 15+ years, both sexes (%)	Ecuador/national	92.83 % (2017)	UNESCO Sustainable Development Goals
Adult literacy rate, population 15-24 years, both sexes (%)	Ecuador/national	99.26 % (2017)	UNESCO Sustainable Development Goals
Adult literacy rate, population 25-64 years, both sexes (%)	Ecuador/national	94.33 % (2017)	UNESCO Sustainable Development Goals
Adult literacy rate, population 65+ years, both sexes (%)	Ecuador/national	72.99 % (2017)	UNESCO Sustainable Development Goals

Source: http://data.uis.unesco.org/index.aspx?queryid=77#
These rates are internationally comparable.

Literacy rates are very high in Ecuador, particularly for the young adult categories. This is a general indicator and was not evaluated at local levels.

H3. Human Capital - Child Labor

Indicator	Scope	Value	Data Source
Child Labor Rate - Children 5-14 years old working 1 or more hours per week	Ecuador/national	4.9 % (2016)	INEC (2017) (Full national survey not completed since 2012)

Farmer-perceived success in eradicating child labor in the banana industry	Ecuador/El Oro, Guayas, Los Rios provinces	Rate: 4.8 (Scale of 1 to 5, 1 being failure, 5 being complete success)	2019 Banana Farmer Survey

The child labor rate is internationally comparable, and reported to ILO.

Background and discussion:

The Government of Ecuador has been a member of ILO-IPEC since 1997 (International Labor Organization of the United Nations International Programme on the Elimination of Child Labour). In 2002, with technical assistance from ILO-IPEC and funding from USDOL (United States Department of Labor), Ecuador began preparatory activities for a Time-Bound Program to eliminate the worst forms of child labor in the country within a determined period of time.

In July 2002, the Ministry of Labor signed an agreement with the banana industry and various national and international organizations to eradicate child labor (for children under the age of 15) from banana plantations by August 2003. In additional to banana, other industry-specific targets included gold mining, cut-flower industry, brick-making industry, and garbage dumps. (There was significant international pressure from civil advocacy organizations at this time – specifically focused on child labor in the banana industry.)

The US Department of Labor (USDOL)'s Bureau of International Labor Affairs (ILAB) has publishes a detailed annual report "Findings on the Worst Forms of Child Labor", beginning in 2002, as mandated by the Trade and Development Act of 2000 (TDA). The TDA requires that countries fulfill commitments to eliminate the worst forms of child labor to be eligible for certain U.S. trade preference programs. Since 2011, the report includes grading of individual countries using ratings of: Significant, Moderate, Minimal, or No Advancement being made on child labor.

The most recent ILAB report, for 2017 (published in 2018), assessed child labor practices in 135 countries designated as trading partners or beneficiaries of US programming. **Ecuador was one 14 out of the 135 countries that earned a "Significant Advancement" assessment, which is the highest rating.**

The ILAB report also highlighted several areas needing improvement in Ecuador:

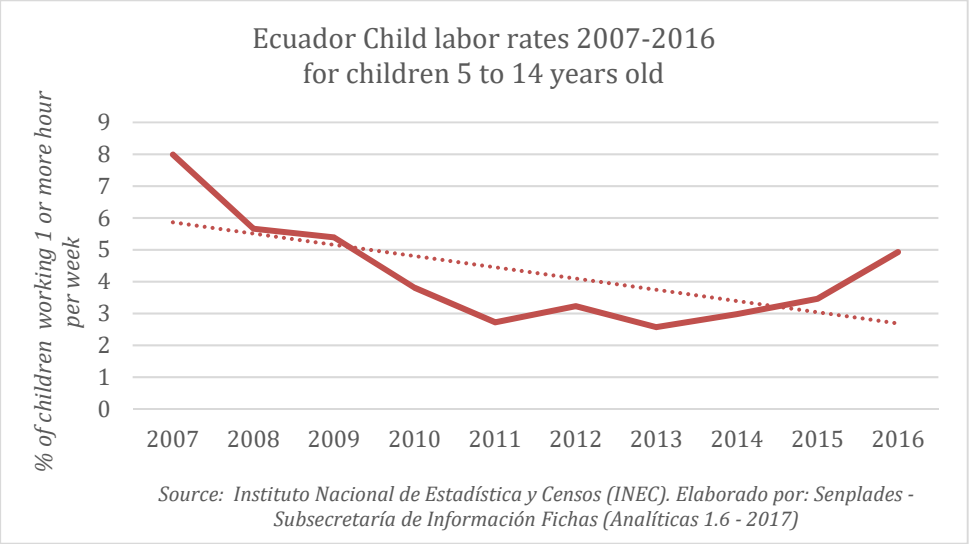
1. Enforcement
    a. More labor inspectors, in accordance with ILO technical guidance
    b. More consistent enforcement, especially for hazardous labor, rural areas, and family-run businesses

c. Better transparency / publication of # of inspections, violations, and penalties (including fines collected)
d. Better resources for inspectors, such as transportation, resources for investigation and follow up
e. Better training for inspectors

2. Coordination
    a. Strengthen coordinating mechanisms between ministries providing social services to victims of child labor, especially in the informal sector, and the mechanism for receiving, routing, and addressing child labor complaints.
3. Social programs
    a. Enhance efforts to eliminate barriers and make education, particularly secondary education, accessible for all children, including indigenous and refugee children and children from rural areas, by removing school-related fees, increasing classroom space, and providing adequate transportation.

Source:
https://www.dol.gov/sites/dolgov/files/ILAB/child_labor_reports/tda2017/ChildLaborReport.pdf

National trends:

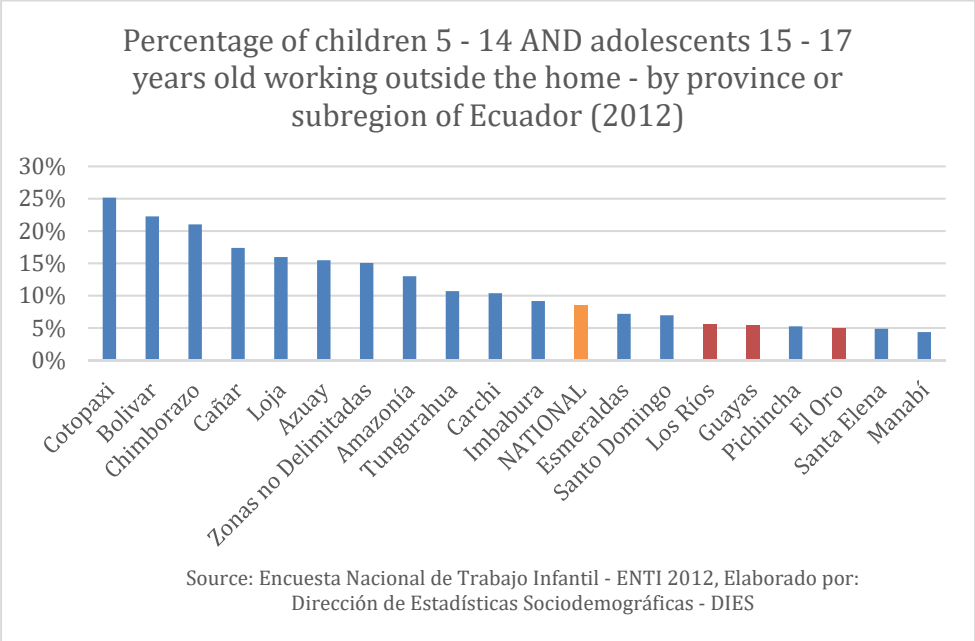


Ecuador's child labor rate has been trending significantly downward since 2002, but small increases were recorded in 2015 and 2016 and should be monitored going forward. Lowland areas, where banana production takes place, consistently has lower rates of child labor and it is unclear if the rate in these regions also increased, as the most recent data is only available at a national level.

Regional rates (2012)

This data includes:

- Children 5-14 years old working 1 or more hours per week
- Adolescents 15-17 years old working more than 30 hours per week OR in dangerous jobs OR conflicting with education.
- ***Key banana regions are noted using a red bar.***



These regional rates are NOT comparable internationally, as Ecuador is merging two categories together to get this rate (child labor and adolescent labor that is non-compliant with national laws). While the published data at a regional scale only shows the merged categories, it gives good indication of differences in child labor rates among regions of Ecuador.

H4. Human Capital – Educational enrollment

Indicator	Scope	Value	Data Source
Total net enrollment, primary, both sexes (%)	Ecuador/national	98.86 % (2017)	UNESCO Sustainable Development Goals

Source: http://data.uis.unesco.org/index.aspx?queryid=77#

Educational enrollment is a useful indicator that inversely correlates with poverty and with child labor. In situations with high child labor rates, educational enrollment rates are often reduced. There is historically little to no significant gender difference in this rate for Ecuador, so the combined rate is used in this assessment.

H5. Human Capital – Life expectancy

Indicator	Scope	Value	Data Source
Life expectancy at birth, total (years)	Ecuador/national	77 years (2017)	UNESCO Sustainable Development Goals

Source: http://data.uis.unesco.org/index.aspx?queryid=77#

Ecuador has a relatively high and increasing life expectancy rate. Regional variations have not been called out. *(*Data does not include impacts from COVID-19.)*

H6. Human capital – Maternal and child health

Indicator	Scope	Value	Data Source
Births attended to by skilled health staff (% of total)	Ecuador/national	97 % (2016)	World Bank
Exclusive breastfeeding (% of children under 6 months)	Ecuador/national	44 % (2012)	INEC / ENSANUT-ECU 2014
Breastfeeding (% of children until 24 months)	Ecuador/national	19 % (2012)	INEC / ENSANUT-ECU 2014
Under 5 mortality rate	Ecuador/national	14.5 per 1000 live births (2018)	UNICEF

*Workplace lactation accommodation at banana farms / lactation rooms	Ecuador/El Oro, Guayas, Los Rios	5% (of farms surveyed) (New law implemented in Ecuador, Fall 2019)	2019 Banana Farmer Survey

Source: https://data.worldbank.org/indicator/SH.STA.BRTC.ZS

Source: https://www.ecuadorencifras.gob.ec//documentos/web-inec/Estadisticas_Sociales/ENSANUT/MSP_ENSANUT-ECU_06-10-2014.pdf

Source: https://data.unicef.org/country/ecu/

Source: http://www.trabajo.gob.ec/wp-content/uploads/2018/01/Acuerdo-Interministerial-003-Lactarios-OFICIAL-1.pdf

As reference: Under 5 mortality rates are highest in the WHO African Region (76 per 1000 live births), around 8 times higher than that in the WHO European Region (9 per 1000 live births). The under 5 mortality rate in USA was 6.9 in 2018. Ecuador was 14.5 in 2018.

Regarding banana plantations, a new law was passed in Ecuador in April 2019 (Health and Labor Inter-ministerial Agreement 003-2019) requiring provision of maternal lactation sites on farms. The metric you see here, 5%, indicates how many of the interviewed farms had this provision in place as the law was just coming into effect. It will be informative to monitor this metric over time, and interesting to learn if the practice extends beyond what is mandated, for example, with smaller farms also providing this employee provision.

H7. Human Capital – Occupational injury rates

Indicator	Scope	Value	Data Source
Minor accidents / frequency (percentage of farms)	Ecuador/El Oro, Guayas, Los Rios	Never: 14% Yes/infrequent: 62% Monthly: 9% Weekly: 9% Daily: 5%	2019 Banana Farmer Survey *(454 farms responding)*

Major accidents / frequency (percentage of farms)	Ecuador/El Oro, Guayas, Los Rios	Never: 96% Yes/infrequent: 4% Monthly: 0% Weekly: 0% Daily: 0%	2019 Banana Farmer Survey *(454 farms responding)*
Agrichemical exposure resulting in sickness / frequency (percentage of farms)	Ecuador/El Oro, Guayas, Los Rios	Never: 89% Yes/infrequent: 10% Monthly: 0% Weekly: 1% Daily: %	2019 Banana Farmer Survey *(454 farms responding)*

Occupational health information is regularly reported to the health ministry and can be accessed at a provincial scale. Extracting data for agriculture from these public data sets is difficult. Within agriculture, we were unable to extract information specifically for the banana sector from public sources. Thus, the 2019 Banana Farm Survey included several questions about occupational health and safety. The survey reports that the most common injuries on banana farms are occasional cuts from using machetes and minor falls. Muscle and joint strains and sprains occur but not often, and exposure to agrochemicals has happened, but is not common, per the reports from the survey. Injuries from tractors or other machinery, which are a major hazard in many agricultural settings, are reported as rare – 93% of the farms report having never had any accident with machinery and 96% never having any major accident of any kind (454 farms responding to the survey question). Comments also note that having the right protective equipment is important, especially for using agrichemicals. A highlighted selection of health and safety responses are included in the indicators, above.

Academic literature points to an occupational safety and health system that has been weak in the past in Ecuador and is currently in a redesign phase. To that end, **in May 2018 Ecuador became the first country to launch the Banana Occupational Health and Safety Initiative (BOHESI) pilot project**, in collaboration with UN FAO's World Banana Forum, Banana Link, Solidaridad, and other partners. (This builds on previous occupational health and safety laws, established in 1986 and revised in 2012.)

The "official launch of the National Manual on Occupational Health and Safety for the Banana Industry (2017) by Ecuadorian Ministry of Labor and Ministry of Agriculture took place on 21 May 2018 in Machala, Ecuador. The launch of the Manual also resulted in the presentation of a new Ministerial Agreement (No. MDT-2018-0108), signed on 16 May 2018, which establishes the compulsory status of the Manual and the legislations included in it."

**We expect to see additional formal data about occupational health and safety in the banana sector coming from this initiative going forward.*

Source: http://www.fao.org/world-banana-forum/projects/banana-occupational-health-and-safety-bohesi/en/

Source: http://www.trabajo.gob.ec/wp-content/uploads/2018/06/MDT-2018-0108.pdf

Source: https://www.gob.ec/regulaciones/decreto-ejecutivo-2393

H8. Human Capital – Pesticide exposure in workers

Indicator	Scope	Value	Data Source
Aerial fungicide spraying for Sigatoka in bananas / Conventional (# of spray cycles per year)	Ecuador/Farms in El Oro, Guayas, Los Rios provinces	Average: 22 spray cycles (2018) Range: 3 to 48	2019 Banana Farm Survey
Aerial fungicide spraying for Sigatoka in bananas / Organic (# of spray cycles per year)	Ecuador/Farms in El Oro, Guayas, Los Rios provinces	Average: 19 spray cycles (2018) Range: 0 to 42 (17% don't spray)	2019 Banana Farm Survey

Human exposure to agrichemicals for both agricultural workers and agricultural communities is one of the most broadly flagged concerns for public health. Aerial spraying of fungicide to control Sigatoka is the most common pathway for humans to come in contact with agrichemicals in the banana industry.

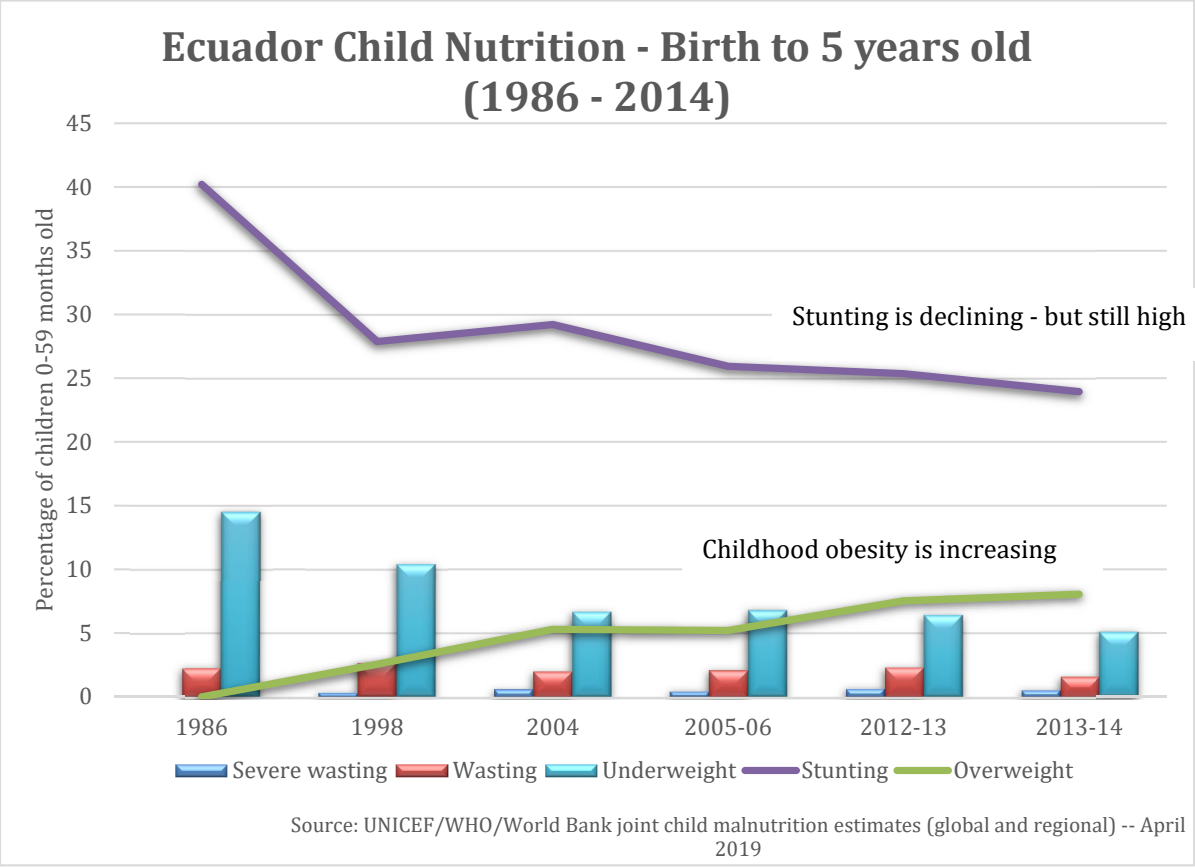
Ecuador currently has a rigorous regulatory structure for the banana sector regarding pesticide application and exposure. Aerial application has strict bylaws and flight plans must be filed and preapproved. And many aviation companies are GPS guided, for precision application. Similarly, larger banana plantations are required to do regular health screenings of all personnel to check for and correct any pesticide contamination. That said – there is a body of literature documenting quality of life impacts on communities in Ecuador related to aerial spraying of bananas, and somewhat more ambiguous body of environmental health literature regarding specific health impacts, as the causal links with specific outcomes are harder to document.

The number of spray cycles for controlling Sigatoka is a useful indicator for this issue, as this is the largest chemical input to the industry, aside from fertilizers, and the potential exposure pathway is much larger. Aside from the portion of organic growers who don't spray at all – the range of application

practices for both organic and conventional systems was broad across all farm sizes and provinces, varying from 3 to 40+ applications per year as reported in the 2019 Banana Farm Survey, with no obvious correlation to reported yields or size of farming operation. There is opportunity for some immediate reduction in chemical use and exposure across the industry through development of improved strategies for managing Sigatoka and optimizing application.

H9. Human Capital – Undernutrition / Overnutrition

Indicator	Scope	Value	Data Source
H9. Stunting (% of population 0-59 months)	Ecuador/national	24% (2013-2014)	UNICEF/WHO/World Bank joint child malnutrition estimates (2019)
H10. Underweight (% of population 0-59 months)	Ecuador/national	5% (2013-2014)	UNICEF/WHO/World Bank joint child malnutrition estimates (2019)
H11. Wasting (% of population 0-59 months)	Ecuador/national	1.6% (2013-2014)	UNICEF/WHO/World Bank joint child malnutrition estimates (2019)
H12. Severe Wasting (% of population 0-59 months)	Ecuador/national	0.6 % (2013-2014)	UNICEF/WHO/World Bank joint child malnutrition estimates (2019)
H13. Overweight (% of population 0-59 months)	Ecuador/national	8 % (2013-2014)	UNICEF/WHO/World Bank joint child malnutrition estimates (2019)



These childhood nutrition indicators are reported on a national level, but the literature notes that rates for undernutrition and stunting is higher in the highlands than in the lowland areas where banana production occurs. It was unclear whether childhood obesity follows the same regional pattern. The important element is that undernutrition rates have steadily declined. The increase rates of childhood obesity is a newer worldwide challenge still linked with food insecurity.

ASSESSMENT RESULTS: SOCIAL AND POLITICAL CAPITAL INDICATORS

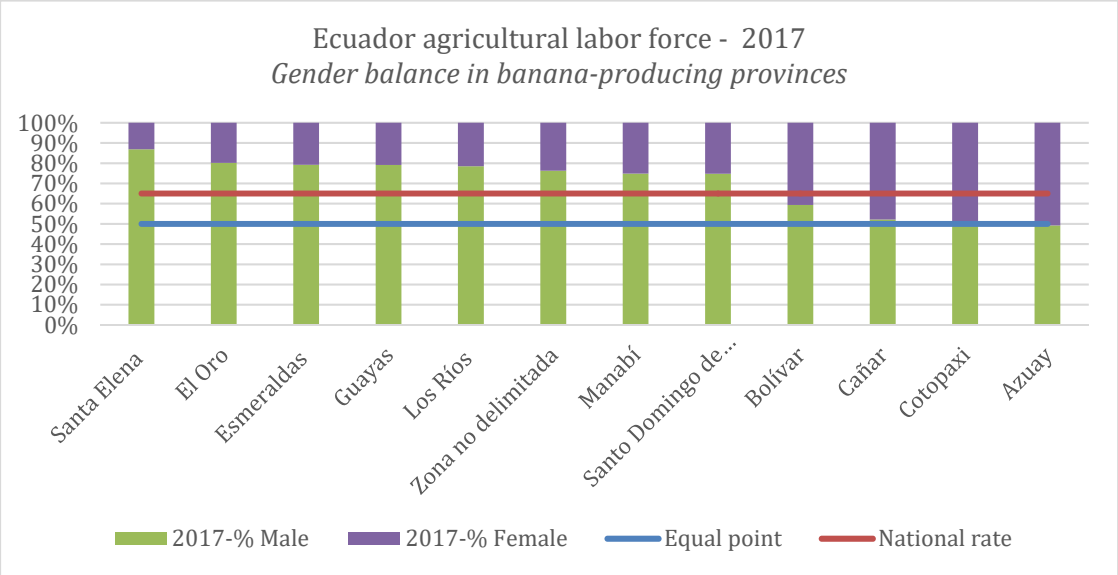
S1.- S2. Social and Political - Agricultural workforce - total and % of population

Indicator	Scope	Value	Data Source
Agriculture workforce - total	Ecuador/national *+ 11 banana producing provinces*	National: 1,889,378 *Azuay: 145,327* *Bolívar: 70,473* *Cañar: 55,023* *Cotopaxi: 139,440* *El Oro: 63,696* *Esmeraldas: 67,189* *Guayas: 218,673* *Los Ríos: 172,848* *Manabí: 206,084* *Santa Elena: 5,227* *Santo Domingo de los Tsáchilas: 37,953* (2017 values)	INEC: PROYECCIONES REFERENCIALES DE POBLACIÓN A NIVEL CANTONAL-PROVINCIAL 2010-2030 (2017)
Agriculture workforce - % of population	Ecuador/national *+ 11 banana producing provinces*	National: 19% *Azuay: 34%* *Bolívar: 65%* *Cañar: 36%* *Cotopaxi: 53%* ***El Oro: 15%*** *Esmeraldas: 20%* ***Guayas: 8%*** ***Los Ríos: 44%*** *Manabí: 23%* *Santa Elena: 2%* *Santo Domingo de los Tsáchilas: 15%* (2017 values)	INEC: PROYECCIONES REFERENCIALES DE POBLACIÓN A NIVEL CANTONAL-PROVINCIAL 2010-2030 (2017) + INEC: Ecuador Agricultural employment 2004-2017 by gender

S3. Social and Political - Agricultural workforce - gender ratio

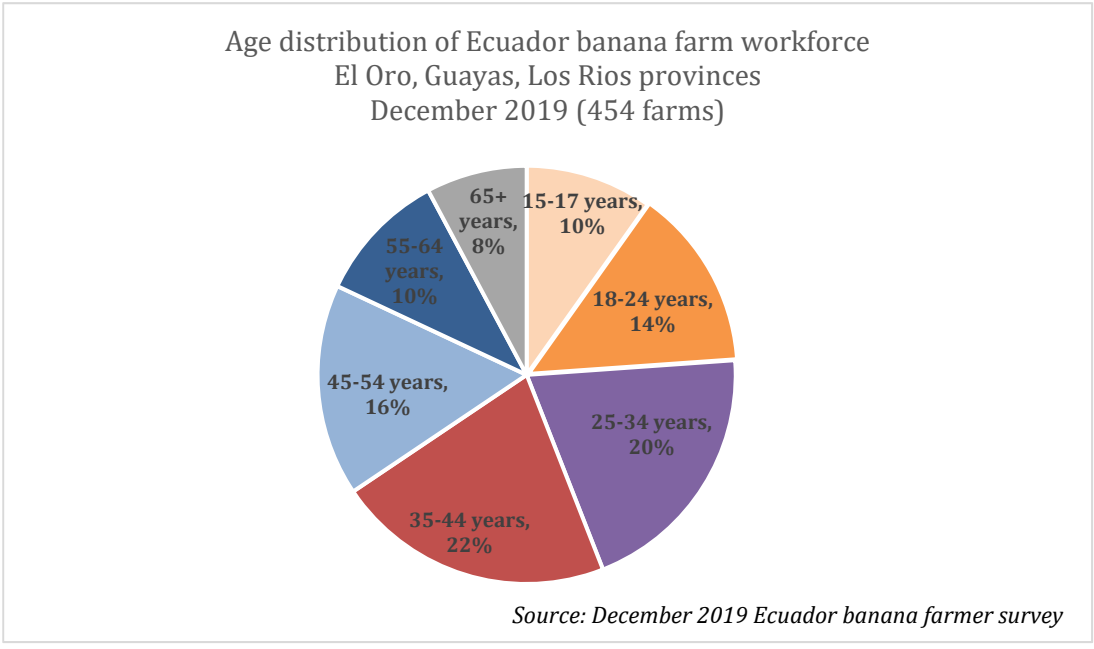
Indicator	Scope	Value	Data Source
Agricultural workforce - Female to Male ratio (1.0 is equal)	Ecuador/national *+ 11 banana producing provinces*	National: 0.54 *Azuay: 1.03* *Bolívar: 0.69* *Cañar: 0.92* *Cotopaxi: 1.03* ***El Oro: 0.25*** *Esmeraldas:0.26* ***Guayas: 0.26*** ***Los Ríos: 0.27*** *Manabí: 0.34* *Santa Elena: 0.15* *Santo Domingo de los Tsáchilas: 0.34* *Zona no delimitada: 0.31* (2017 values)	INEC: Ecuador Agricultural employment 2004-2017 by gender
Agricultural workforce - Female to Male ratio (1.0 is equal)	Ecuador/Banana farms	El Oro, Guayas, Los Rios (combined): 0.36 (2019 values)	2019 Ecuador Banana Farm Survey (454 farms)

Issues S2 and S3 look at composition of the agricultural workforce in banana producing regions. Agriculture is a major source of employment across Ecuador and the banana industry plays a large employment role in the more dense production zones. Looking at the gender ratio aspect of agricultural employment, it's noteworthy that women's participation rate in the three dominant banana producing provinces El Oro, Guayas, Los Rios is half of the national average, or about a quarter of men's participation rate. Meanwhile - the 2019 farmer survey found women's employment on banana farms to somewhat higher than the provincial average, at one third of men's employment participation in bananas. Better engagement of women in the workforce could be an important response to a reduced rural workforce in coming years.



S4. Social and Political - Agricultural workforce - age distribution

Agricultural workforce / % of workers aged 55 and older	Ecuador/Banana farms in El Oro, Guayas, Los Rios provinces	% of workers 55+: 18%	2019 Ecuador Banana Farm Survey (454 farms)



Stakeholders have indicated that an aging agricultural workforce is becoming a challenge for the banana sector -- counter to what is happening in the general population, and the trend is expected to become greater as time progresses. This demographic trend is similarly happening around the world, particularly in middle and high income countries. However, looking at the age distribution of agricultural workers from our December 2019 banana farm survey: workforce aging does not appear to be as pressing as feared. Currently, 18% of banana farm employees are age 55 or older.

S5. Social and Political Capital - Corruption

Indicator	Scope	Value	Data Source
Corruption Perceptions Index	Ecuador/national	Score: 38 (2019 - Score of 0 is highly corrupt and 100 is very clean) Rank: 93 (out of 180 countries / lower is less corrupt)	Transparency International
Corruption Perceptions / % of respondents	Ecuador/El Oro, Guayas, Los Rios farmers	% feeling corruption in Ecuador is: Decreasing: 6% No change: 38% Increasing: 56%	2019 Ecuador Banana Farm Survey / this assessment (446 responses)

Source: https://www.transparency.org/cpi2019?/news/feature/cpi-2019

Albeit still having relatively high levels of corruption noted, Ecuador's corruption metrics have been slowly improving since 2016, according to the Corruption Perceptions Index. Alternatively - perceptions among banana farmers, according to our 2019 survey, are that corruption in the county has remained the same or increased, and that the industry is impacted by the corruption. The difference may be that the legal structures are improving, but have not yet translated to societal impacts

S6. Social and political capital: Drug trafficking – cocaine

Indicator	Scope	Value	Data Source
Annual drug seizures, cocaine	Ecuador/national	84.5 Metric Tons (equivalents of pure cocaine) (2017)	United Nations Office on Drugs and Crime (UNODC)
Annual drug production, cocaine	Global (70% Colombia, 20% Peru, 10% Bolivia)	1650 Metric Tons (2018-estimate)	White House Office on United Nations Office on National Drug Control Policy and UNODC

Source: https://dataunodc.un.org/drugs/seizures-2017

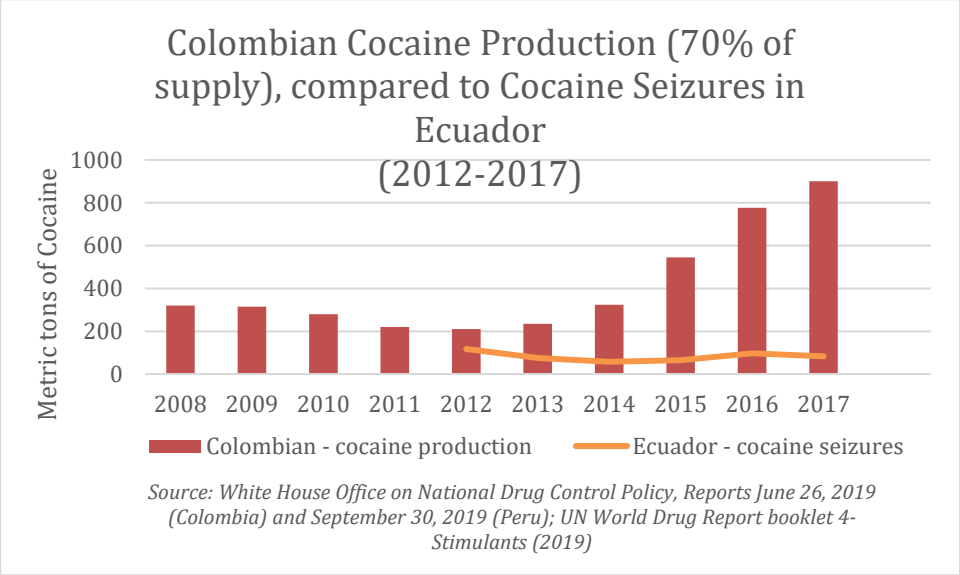
Source: https://www.whitehouse.gov/briefings-statements/ondcp-reports-cocaine-production-colombia-leveling-off/

Source: https://www.whitehouse.gov/briefings-statements/ondcp-releases-data-coca-cultivation-production-peru/

More detail: https://wdr.unodc.org/wdr2019/prelaunch/WDR19_Booklet_4_STIMULANTS.pdf

Discussion: 70% of global cocaine supply came from Colombia, 20% from Peru, and 10% from Bolivia in 2017. While there are many distribution channels, significant amounts of the cocaine is distributed to North America, Europe, and other markets through Ecuador, and banana exporters are directly impacted by these distribution channels. Banana exporters go to extreme security measures to deter illegal drug products from being inserted into their fruit shipments and facing severe restrictions from receiving ports when they are found – costing time, money, and potential market access, as well as concerns for personal safety. 2017 had the highest ever production of cocaine with global production equaling almost 1,976 tons of pure cocaine, which is 25% more than produced in 2016. Production in 2018 tapered off to slightly under 2017 levels, and numbers for 2019 are not yet available. Drug seizures in Ecuador have not risen in proportion with the significant growth in supply. Looking further into the data-- eradication and seizure efforts in Bolivia are largely successful – and only a small portion of coca in cultivation ever enters the cocaine supply chain. In Peru, eradication and seizure efforts were roughly keeping up, but have been declining while cultivation increases since 2015. For Colombia, data

show that eradication efforts peaked around 2008, and fell to almost nothing by 2016 when crop spraying seems to have been discontinued. Manual eradication has increased slightly in 2017. A majority of cocaine trafficked through Ecuador is thus assumed to originate in Colombia.



Source: White House Office on National Drug Control Policy, Reports June 26, 2019 (Colombia) and September 30, 2019 (Peru); UN World Drug Report booklet 4-Stimulants (2019)

**DATA GAP / Desired metric: banana industry spending on security, to be correlated as an added expense related to the drug trafficking.*

S7. Social and political capital: Cultivation and processing practices of bananas (set)

Indicator	Scope	Value	Data Source
Yield / boxes per hectare per year	Ecuador/ Banana farms in El Oro, Guayas, Los Rios provinces	Conventional (2018) Average: 2354 boxes Range: 400 to 4160 Organic (2018) Average: 2154 boxes Range: 500 to 4200	2019 Banana Farm Survey
Certification programs / participation rates - % of farms surveyed	Ecuador/ Banana farms in El Oro, Guayas, Los Rios provinces	GlobalGAP: 74% Rainforest Alliance: 15% Fairtrade: 3% USDA Organic: 2% EU Organic: 4%	2019 Banana Farm Survey

		Other organic: 9% *NO certifications: 21%*	
Pest management: Plan in place to manage Fusarium oxysporum (Foc R4T) / % of farms surveyed	Ecuador/ Banana farms in El Oro, Guayas, Los Rios provinces	Yes: 68% No: 32% (December 2019 / 459 farms.) Note: 82% reported that they have received information from MOA/others	2019 Banana Farm Survey
Field management practices for carbon and water efficiency / % of surveyed farms practicing	Ecuador/ Banana farms in El Oro, Guayas, Los Rios provinces	Crop rotation: 1% Cover crops: 7% Compost: 24% Fertigation: 19% Intercropping: 2% (December 2019 / 459 farms.)	2019 Banana Farm Survey
Field management: drainage / % of surveyed farms with drainage canals	Ecuador/ Banana farms in El Oro, Guayas, Los Rios provinces	Yes: 97% No: 3% (December 2019 / 459 farms.)	2019 Banana Farm Survey
Field management: buffer zones / % of surveyed farms practicing	Ecuador/ Banana farms in El Oro, Guayas, Los Rios provinces	Spray--herbicide: 18% Cut--machinery: 31% Cut—machete: 60% Plant--ornamentals (non-native): 9% Plant--fruit trees: 9% Plant--native plants: 9% Fence--wood: 2% Fence--wire: 9%	2019 Banana Farm Survey (December 2019 / 459 farms.)

This farm management practices section (S7) highlights several key areas where on-farm strategies to improve sustainability could be added or improved through a number of approaches.

1. Yield metrics, and in combination with pesticide metrics later, provide data showing a large range between the lowest and highest yielding farms. Surprisingly – this yield differential, and also a large differential in the cycles of aerial spray for Sigatoka, were not correlated, nor were they correlated with farm size or province. Which means there are innovative and productive farm at all scales and in all provinces, and also less skilled or productive farms across the spectrum. Development of an expanded set of guidelines and technical trainings across the industry could prove extremely beneficial.
2. Fusarium – a solid portion of farms have a planned responses to the fusarium threat –which is really positive. Additional outreach could be beneficial to help the rest prepare.
3. The UN FAO's World Banana Forum (WBF) management recommendations to improve soil health and manage carbon have been controversial in Ecuador, and many feel they are not calibrated for commercial banana production. The 2019 Banana Survey catalogued adoption of WBF carbon and soil management recommendations and found limited adoption of strategies. It could be worth exploring if there are more appropriate adaptations to these practices in Ecuador that could be formalized, and/or to consider adaptation to potential regulatory restrictions that make it difficult to test these practices.
4. Field drainage rates are high in this group, which has evidently been increasing over time—and provides a useful tool for managing climate/weather related risk.
5. Buffer zones: respondents seemed a bit unsure on what buffer zones were required in different situations. There is huge opportunity to use these buffers to promote wildlife connectivity and beneficial insects. Our UC Davis team and some partners in Ecuador have already begun exploring some of these opportunities.

S8. Social and political capital: Digital access

Indicator	Scope	Value	Data Source
% of population with mobile cellular telephone	Ecuador/national	92 % (2018)	ITU World Telecommunication/ICT Indicators Database.
% of population using internet	Ecuador/national	57% (2017)	ITU World Telecommunication/ICT Indicators Database.

Ecuador is well connected digitally via mobile phone, even if internet access is still somewhat limited. This digital connectivity is important for communication and promoting innovation.

S9-S13. Social and political capital – business climate

Indicator	Scope	Value	Data Source
S9. Ease of doing business Index (Rank of 1=most business-friendly regulations)	Ecuador/national-overall	Score: 57.94 (2019) Rank: 123 (out of 190 economies measured)	The World Bank
S10. Ease of doing business Index (Rank of 1=most business-friendly regulations)	Ecuador/national-Registering property	Score: 65.79 (2019) Rank: 75 (out of 190 economies)	The World Bank
S11. Ease of doing business Index (Rank of 1=most business-friendly regulations)	Ecuador/national-Paying taxes	Score: 59.38 (2019) Rank: 143 (out of 190 economies)	The World Bank
S12. Ease of doing business Index (Rank of 1=most business-friendly regulations)	Ecuador/national-Getting credit	Score: 45 (2019) Rank: 112 (out of 190 economies)	The World Bank
S13. Ease of doing business Index (Rank of 1=most business-friendly regulations)	Ecuador/national-Enforcing contracts	Score: 59.38 (2019) Rank: 79 (out of 190 economies)	The World Bank

Source: https://www.doingbusiness.org/en/data/exploreeconomies/ecuador
For comparisons across Latin America:
https://www.doingbusiness.org/en/rankings?region=latin-america-and-caribbean

The Ease of Doing Business Index identifies and compares Ecuador's business practice and potential challenges globally. A few components of this index, including contract enforcement, property rights, and taxes, are shown separately from the broader index, as these topics were highlighted as issues of concern during stakeholder conversations.

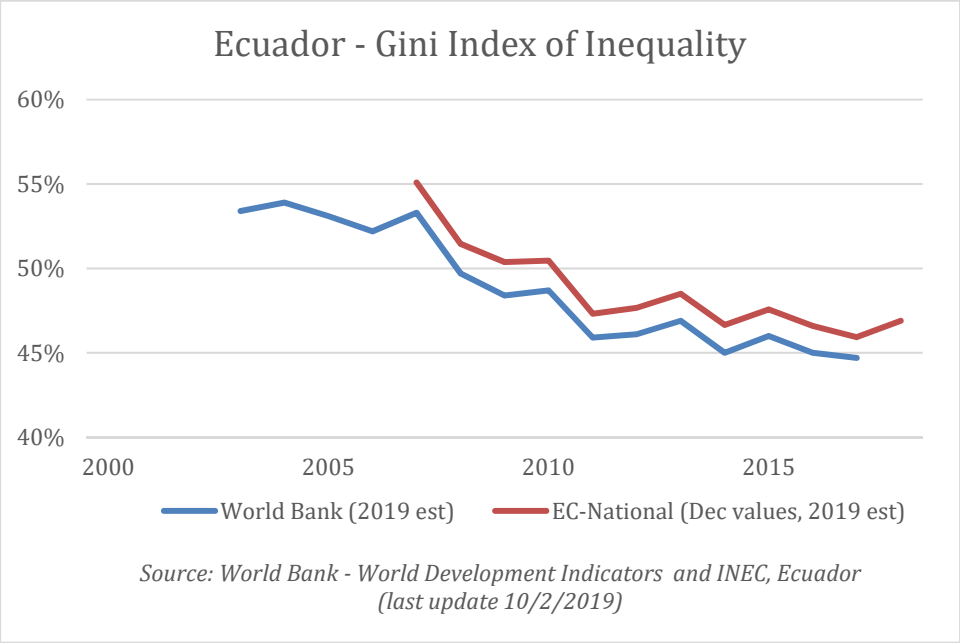
S14. Social and Political Capital - Inequality

Indicator	Scope	Value	Data Source
Gini Index of Inequality	Ecuador/national	46.9 % (December 2018)	INEC (2019)

This rate is internationally comparable, and calculated independently by Ecuador and the World Bank. The rate calculated by INEC/Ecuador is slightly higher than the World Bank rate. Both are trending down over time, meaning that the Ecuador is becoming more equal.

Source: INEC: https://www.ecuadorencifras.gob.ec/coeficientes-de-gini-por-ingresos-2/

World Bank: https://data.worldbank.org/indicator/SI.POV.GINI?view=map&year=1999

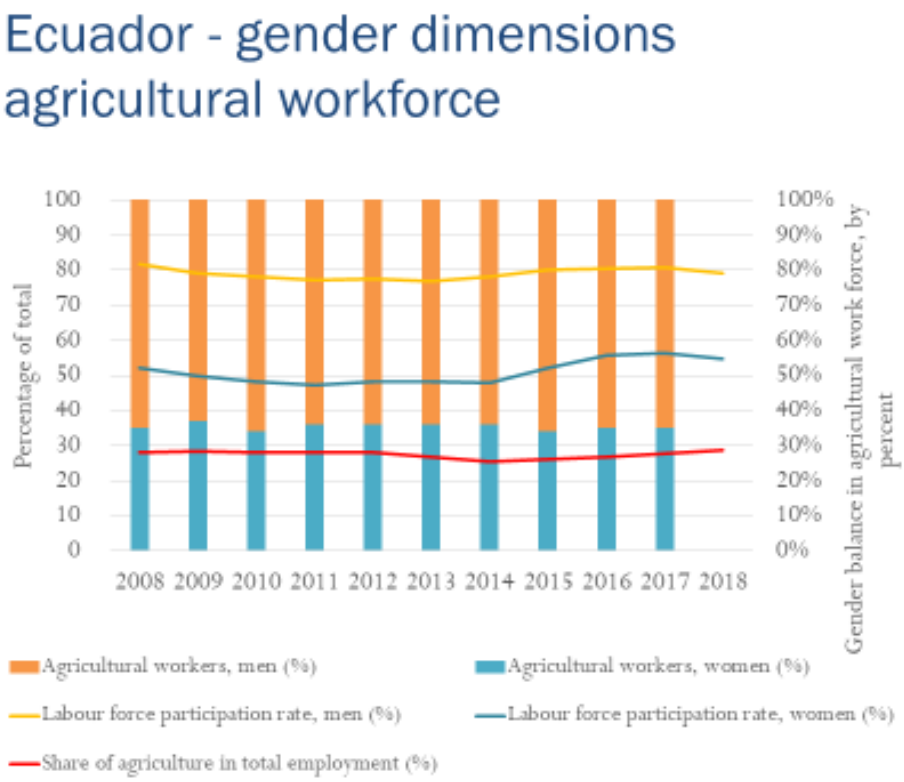


Economic inequalities in Ecuador have been steadily trending downward –which is desirable, and good to keep monitoring over time.

S15. Social and political capital – Labor force participation

Indicator	Scope	Value	Data Source
Labor force participation - % of working age population, all	Ecuador/national	65.3 % (December 2019)	INEC/ENEMDU 2019
Labor force participation - % of working age population, RURAL	Ecuador/national	72.3 (December 2019)	INEC/ENEMDU 2019

Source: https://www.ecuadorencifras.gob.ec/empleo-diciembre-2019/



The indicators above (S15) shows labor force participation, which is a rate tracking the proportion of working age population engaged in the workforce. This rate is the counter or opposite of unemployment. Ecuador also has a separate metric to monitor full employment, which tracks similar to

the base participation rate here. It is interesting that rural employment participation rates are higher than the total/urban rates.

The chart also breaks down labor force participation by gender, and for the agricultural work force. The agricultural workforce proportion has been flat, or unchanging, for the last decade. Women's participation in the workforce has increased, but the increase has not gone to the agricultural sector.

S16. Social and political capital – Labor inspection

Indicator	Scope	Value	Data Source
Number of Labor Inspectors	Ecuador/national	150 inspectors (2017)	INEC/ENEMDU 2016 (Via UNICEF + US DOL)

Source: INEC: Proyeccion_Provincial_Urbano_Rural_Grupos_Edades_Sexo_2010_2020 (2012 study)
Source: ILO - https://www.ilo.org/ilostatcp/CPDesktop/?list=true&lang=en&country=ECU (2016 EDEMU original source)
Source: US DOL REPORT - https://www.dol.gov/sites/dolgov/files/ILAB/child_labor_reports/tda2017/Ecuador.pdf (US Embassy request to EDEMU 2018 original source)

The International Labor Organization (ILO) advises using a ratio of 1 labor inspector for every 15,000 workers in developing economies (as noted in child labor rate reporting). Ecuador's workforce in 2019 was 8.6 million workers and the labor force participation rate was estimated at 65.3% (December 2019/ENEMDU). Using ILO recommendations, Ecuador should employ about 374 labor inspectors, which is more than double the last posted number (2017). The referenced ILO and US DOL reports also suggest that inspectors often lack necessary resources, such as transportation, to fulfill their mandate, so some additional investment would be needed in this area to adequately enforce labor policies and help meet the national goals for labor enforcement and eradicating child labor.

This assessment recommends increasing capacity and investment in labor inspections following ILO recommendations to enable consistent enforcement of existing laws. It is noted, however, that that the data being used is national in scale. While it is certain that current enforcement capacity is limited across Ecuador, calibrating and tracking staffing and resources at the provincial scale for banana producing regions going forward would be beneficial to demonstrate sufficient regulatory capacity in key regions, and potentially provide additional documentation to support findings of third party certifiers.

S17. Social and political capital –Land tenure & size of farms

Indicator	Scope	Value	Data Source
Number of registered banana farms - 2017	Ecuador/national	5,690 (2017)	Ecuador Ministry of of Agriculture (2019)
Registered banana farms – 2017 (total hectares)	Ecuador/national	162,521 (2017)	Ecuador Ministry of of Agriculture (2019)
Size distribution of banana farms - 2017	Ecuador/national	Small farms (<30 hectares): 4274 farms / 35,683 hectares - 75% of total farms - 22% of farm area. Medium farm (30>100 hectares): 1082 farms / 58,620 hectares - 19% of farms - 36% of farm area Large farms (100 ha or more): - 334 farms / 68,217 hectares - 6% of farms - 42% of farm area.	Ecuador Ministry of of Agriculture (2019)
Banana farm ownership – 2019	Ecuador/ Banana farms in El Oro, Guayas, Los Rios provinces	1 family: 89% 2 or more families: 5% Local corporation: 1% National corporation: 3% Foreign or multinational corporation: 2% (December 2019 / 472 farms.)	2019 Banana Farm Survey

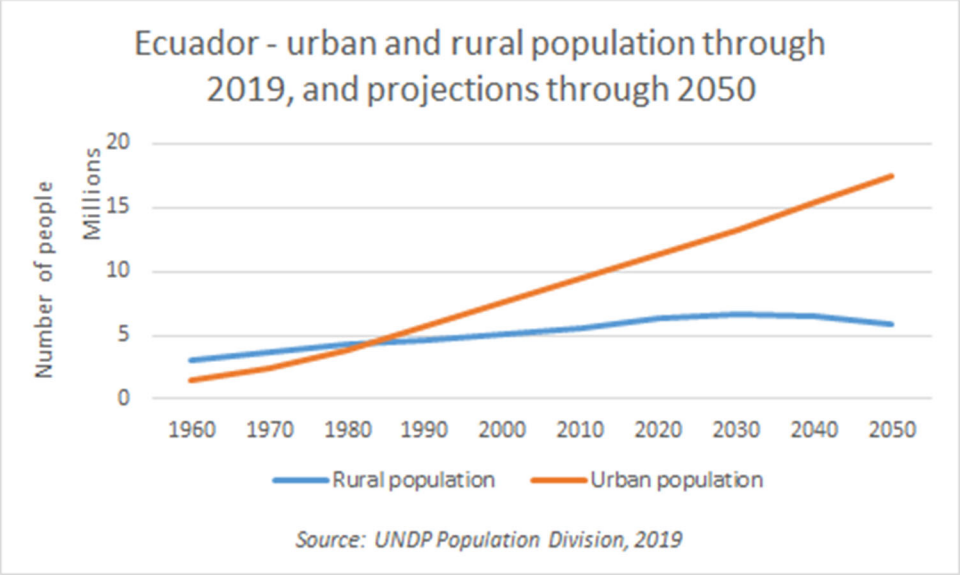
This set of indicators shows the distribution of banana farm size, land area, and also ownership patterns. It is notable that Ecuador has strong production capacity at all scales, and that 94% of farms are family owned.

S18. Social and political capital –Population (set)

Indicator	Scope	Value	Data Source
Population - 2017 (number of people-all)	Ecuador/national + 11 banana producing provinces	National: 16,776,977 *Azuay: 838,859* *Bolívar: 205,094* *Cañar: 267,643* *Cotopaxi: 470,167* *El Oro: 689,760* *Esmeraldas:567,610* *Guayas: 4,207,610* *Los Ríos: 888,351* *Manabí: 1,523,950* *Santa Elena: 375,646* *Santo Domingo de los Tsáchilas: 485,090* (2017 values)	INEC: PROYECCIONES REFERENCIALES DE POBLACIÓN A NIVEL CANTONAL-PROVINCIAL 2010-2030 (2012)
Population - 2017 (rural - % of total)	Ecuador/national-rural + 11 banana producing provinces-rural	National: 0.54 *Azuay: 45%* *Bolívar: 69%* *Cañar: 54%* *Cotopaxi: 68%* *El Oro: 22%* *Esmeraldas:40%* *Guayas: 15%* *Los Ríos: 44%* *Manabí: 41%* *Santa Elena: 46%* *Santo Domingo de los Tsáchilas: 25%* (2017 values)	INEC: PROYECCIONES REFERENCIALES DE POBLACIÓN A NIVEL CANTONAL-PROVINCIAL 2010-2030 (2012)

Population - projected 2030 & 2050 (number of people - all)	Ecuador/national	2030: 19.8 Million 2050: 23.3 Million	UNDP Population Division (2019)
Population - projected 2030 & 2050 (rural - number of people and % of population)	Ecuador/national-rural	2030: 6.6 M / 33% 2050: 5.9 M / 25%	UNDP Population Division (2019)

Ecuador, as much of the world, is in the process of urbanizing. INEC has projections out to 2030 at both provincial and canton levels, whereas UNDP has national projections for Ecuador to 2050. The algorithms differ slightly, but the general trends agree: the percentage of the population living in cities is projected to continue to grow steadily, and the actual number of people living in urban areas is projected to grow quickly over the next 20-30 years. Meanwhile, the *percentage* of the population living in rural areas is currently declining steadily. The rural population in Ecuador is expected to peak and **the number of people living in rural areas to begin declining around 2030**, at a national level.



At the provincial and canton level (from INEC), data are only available to 2030 at this time. Reviewing population projections in banana production areas, we find two cantons that are expected to begin losing population between 2020 and 2030: Palenque, in Los Rios province, and Pucara, in Azuay province.

Note: INEC projections seem to indicate the rural peak arriving a few years later than UNDP projections. All of these projections are extrapolated from Ecuador's 2010 population census. The planned 2020 national census will enable updated and more accurate population projections.

S19. Social and political capital – Poverty headcount ratio at $3.20 a day (2011 PPP) (% of population)

Indicator	Scope	Value	Data Source
Poverty headcount ratio at $3.20 a day (2011 PPP) (% of population)	Ecuador/national	8.7% (2017)	UNESCO – Sustainable Development goal (SDG) 4

This rate is internationally comparable, and available for comparison at:
http://uis.unesco.org/sites/default/files/documents/countryprofiles/EC.pdf

S20. Social and political capital – Poverty headcount ratio at Ecuador national poverty lines (% of population)

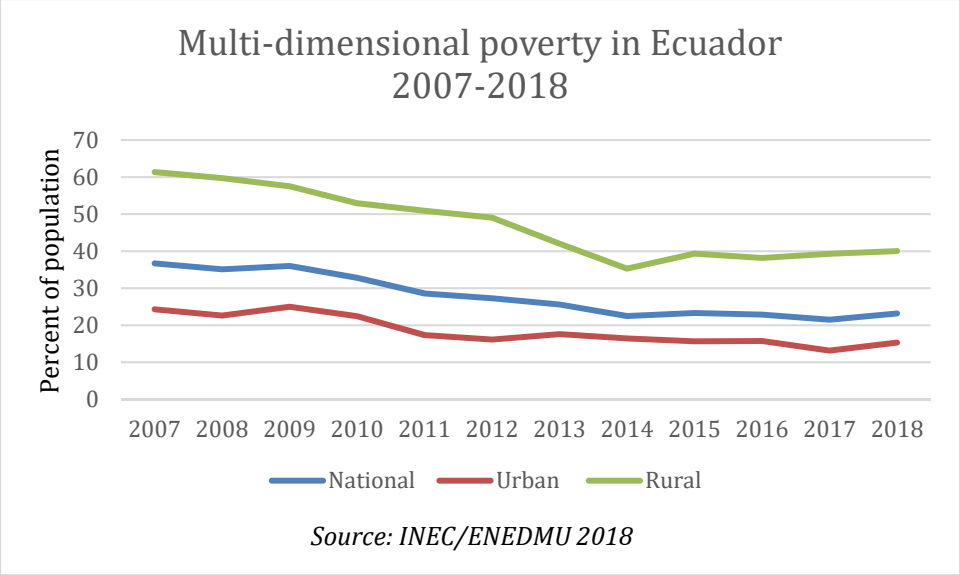
Indicator	Scope	Value	Data Source
Poverty headcount ratio at national poverty lines –all (% of population)	Ecuador/national	37.9% (December 2018)	INEC/ENEMDU (2019)
Poverty headcount ratio at national poverty lines - urban (% of population)	Ecuador/national-urban	23.9% (December 2018)	INEC/ENEMDU (2019)

Poverty headcount ratio at national poverty lines – rural (% of population)	Ecuador/national-rural	67.7% (December 2018)	INEC/ENEMDU (2019)

This rate is internationally comparable, and available for comparison at: https://data.worldbank.org/topic/poverty.

The Poverty headcount ratio at national poverty lines (% of population) is a multidimensional poverty rate (MDP) calculated by equally weighing:

1. Education -- participation (children) and attainment (adult): 25%
2. Work and social security: 25%
3. Access to health, clean water, and adequate nutrition: 25%
4. Housing and sanitation – including both household sanitation and garbage service: 25%



Source: INEC/ENEDMU 2018

Since the adoption of this metric in 2009, the rate has been steadily trending downward.

Source: INEC: https://www.ecuadorencifras.gob.ec/documentos/web-inec/POBREZA/2018/Diciembre-2018/201812_Pobreza.pdf

https://www.ecuadorencifras.gob.ec/trabajo-infantil/

S20. Social and political capital – Poverty headcount ratio using NBI Index (basic needs index / similar to MDP rate, above, but with a different algorithm)

**NBI was used to calculate poverty in the last 3 national censuses (1990, 2001, 2010). Below is an overview of poverty trends in banana producing provinces and cantons.*

CANTON LEVEL: Poverty trends in 49 banana production cantons. Data collected with 10 year census:

- Changes in poverty between 1990 & 2001 censuses

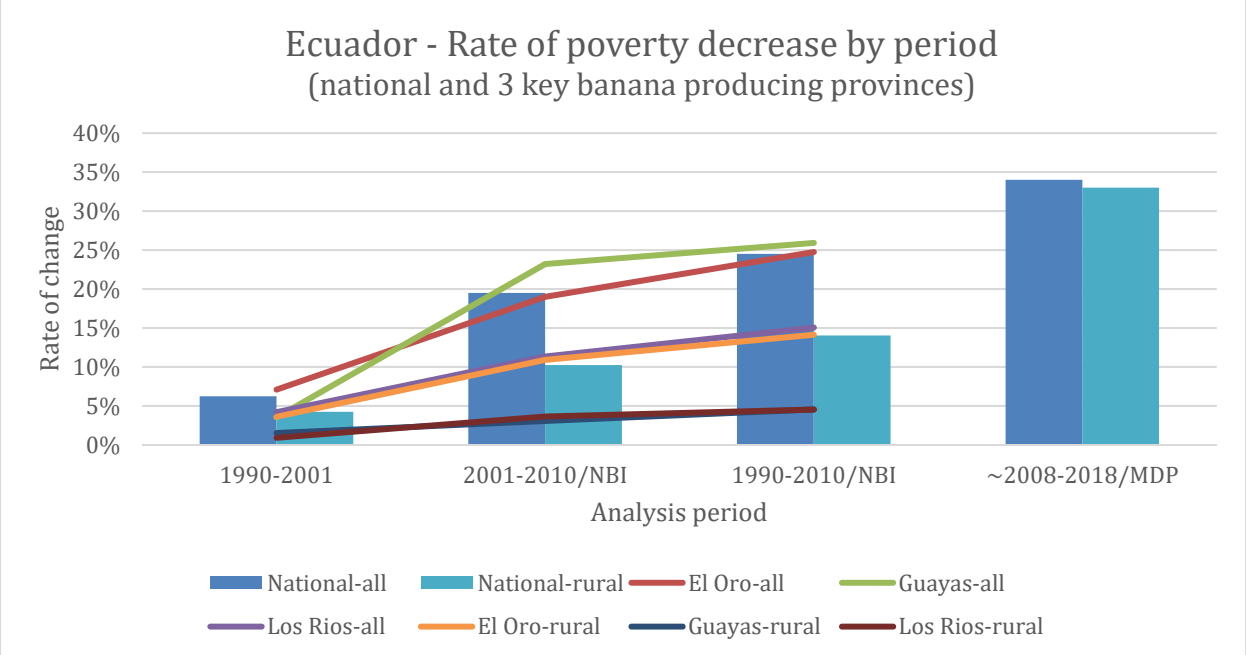
  o 3 cantons showed overall improvement greater than 10%

  o 6 cantons showed zero or negative improvement in overall poverty rates from 1990-2001, and 13 cantons showed zero or negative improvement in rural poverty rates

- Changes in poverty between 2001 & 2010 censuses

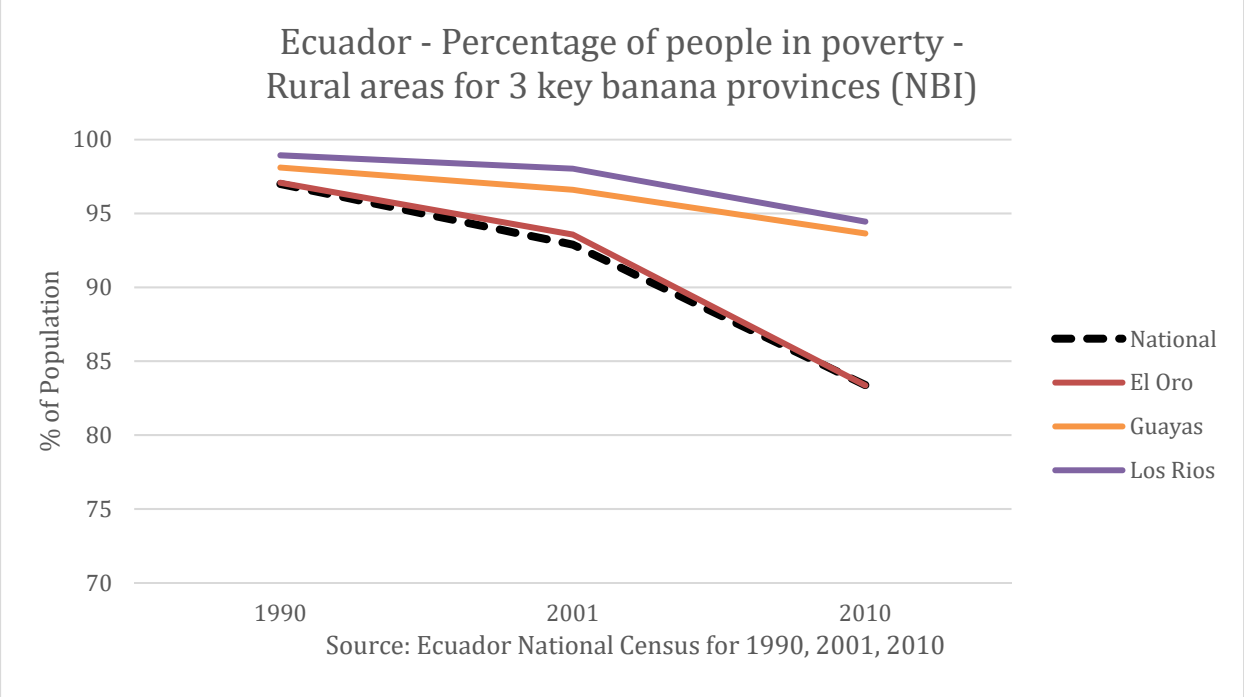
  o All 49 banana-producing cantons showed overall improvement in poverty rates between 2001-2010 – with 24 of 49 cantons showing a 10% or more overall decrease in poverty, and 6 cantons showing 20% or more decrease.

  o Rural poverty also generally declined during this period, but at a slower rate than overall values: just 7 cantons showed a 10% or more decrease in rural poverty; whereas 3 cantons continued to show zero or increased rural poverty. Note: Only one of the three zero/increased poverty cantons has significant banana production (Valencia, in Los Rios).

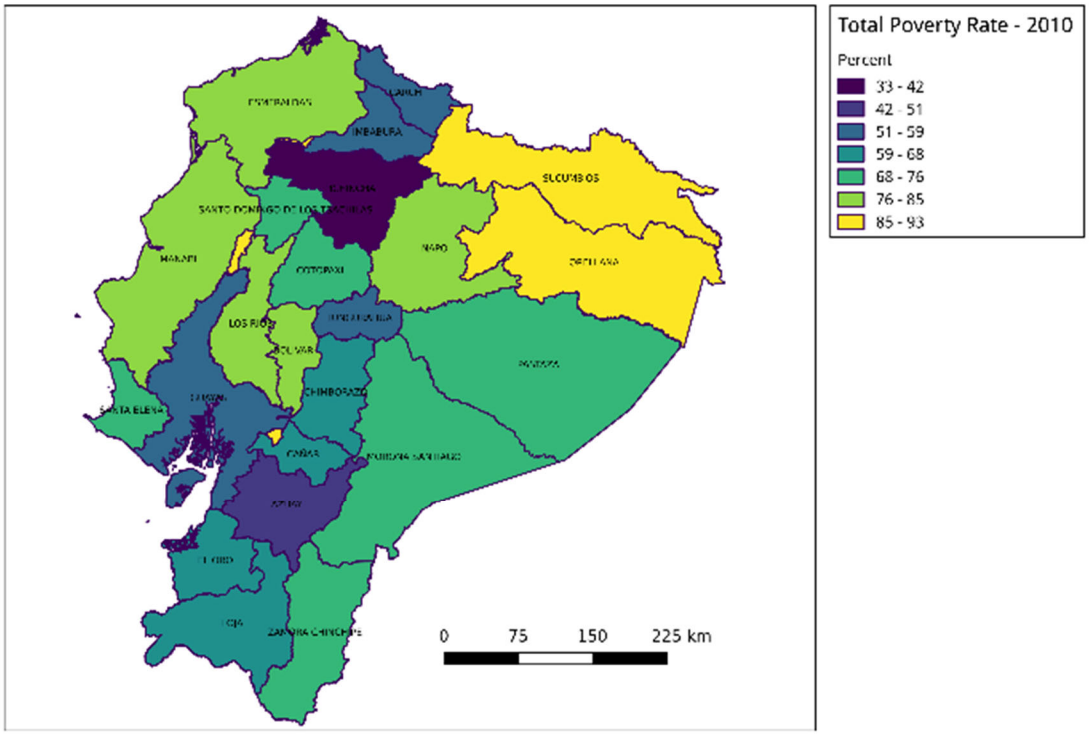


The 2020 national census will give updated poverty information at the provincial and canton level. We see using the MDP rate that poverty in Ecuador has continued to decline since 2010 and we are interested to see how banana-producing regions compare. El Oro province, in particular, seems to be reducing poverty faster than most regions of the country in both urban and rural areas.

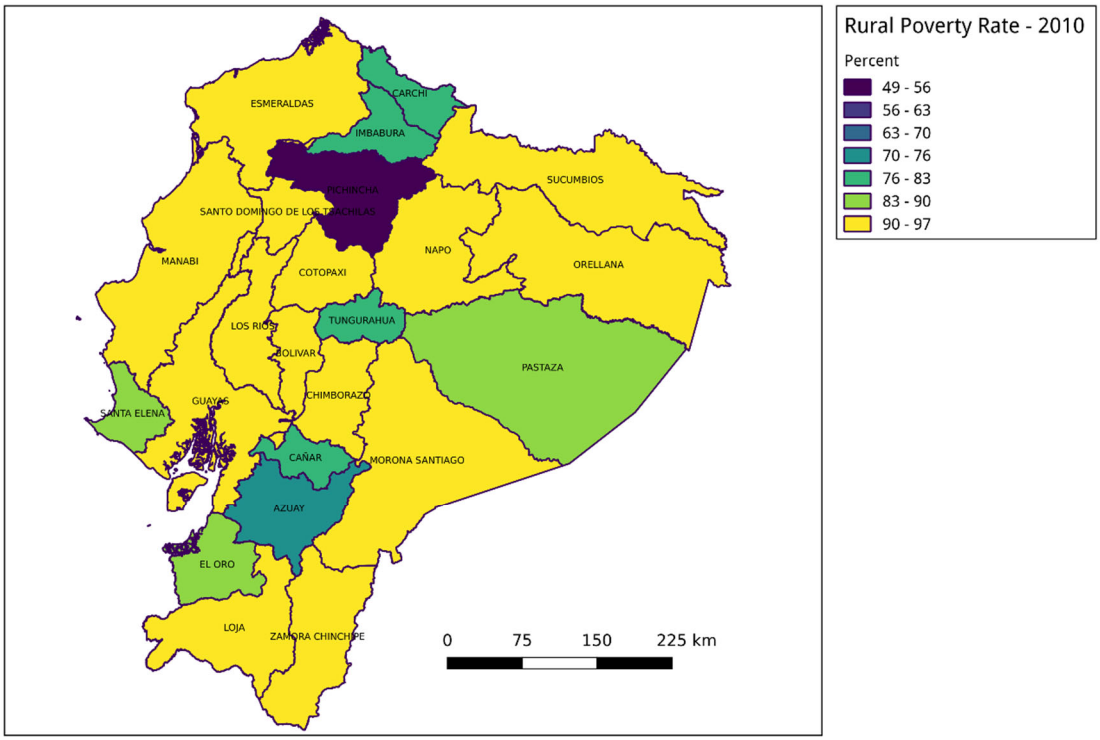
https://www.ecuadorencifras.gob.ec/censo-de-poblacion-y-vivienda/



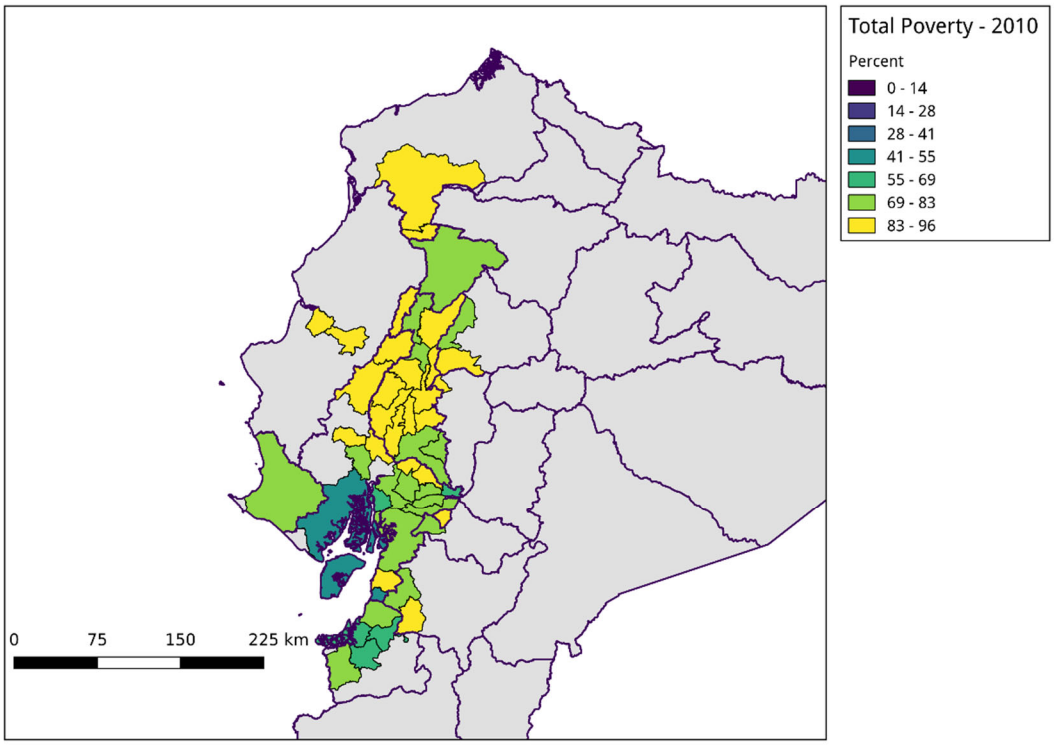
Mapping of Poverty – All Provinces 2010 – all areas

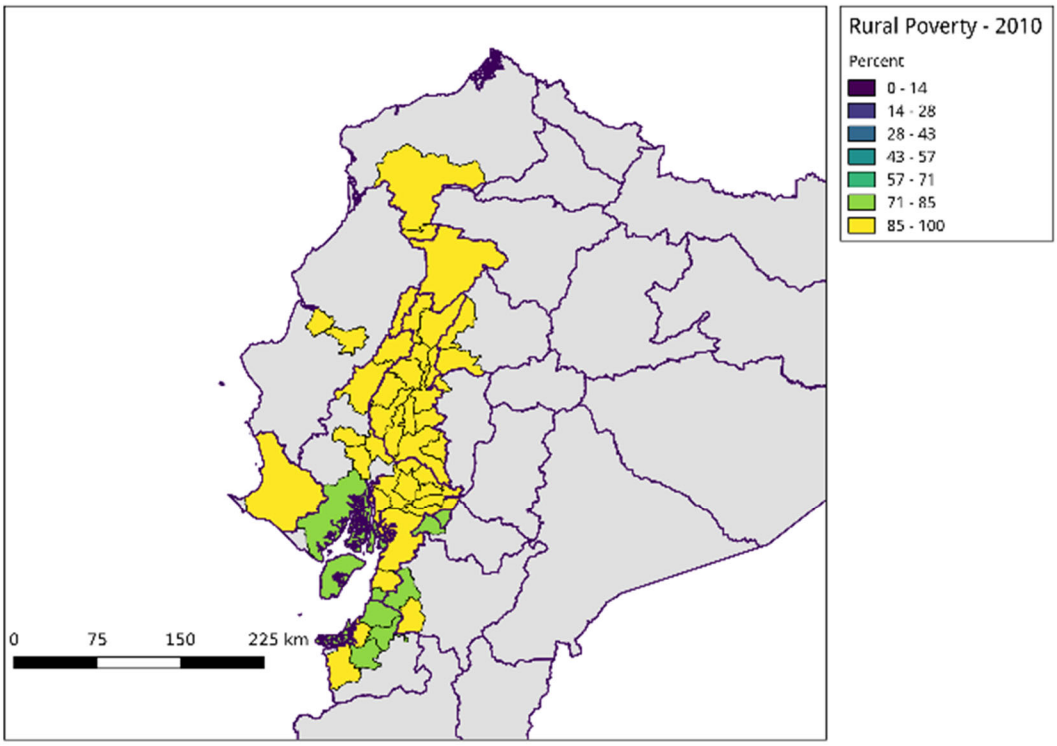


Mapping of Poverty – All Provinces 2010 – RURAL

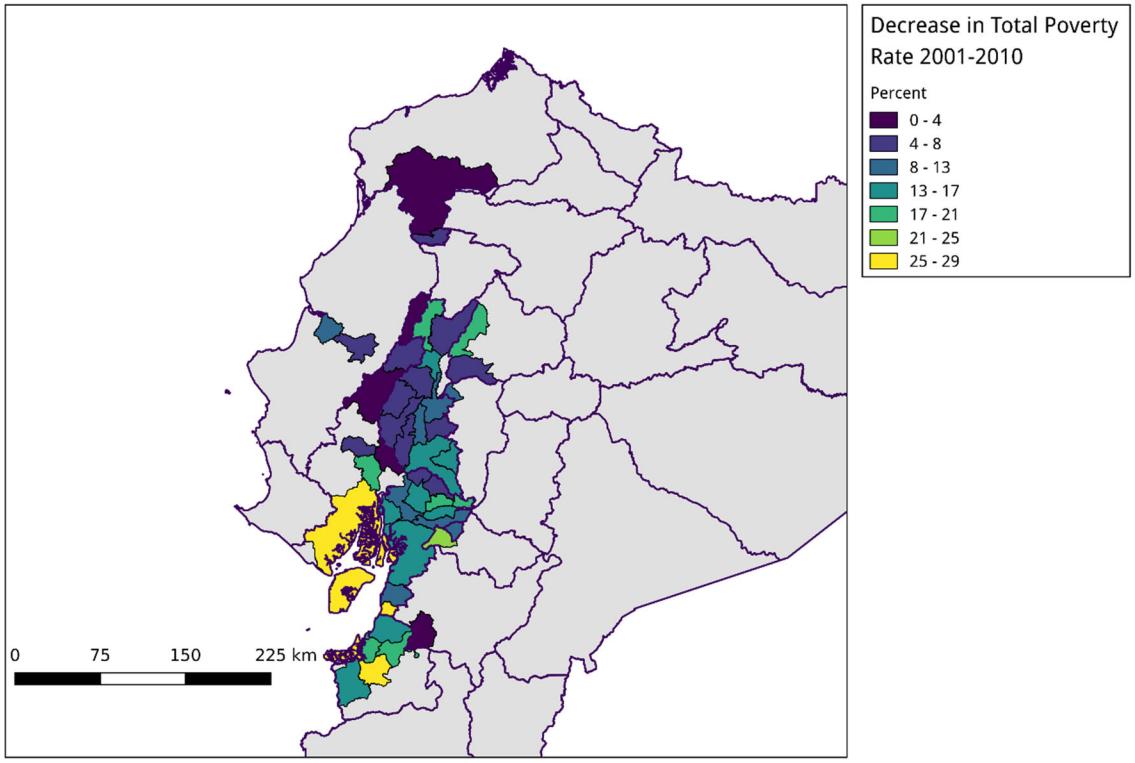


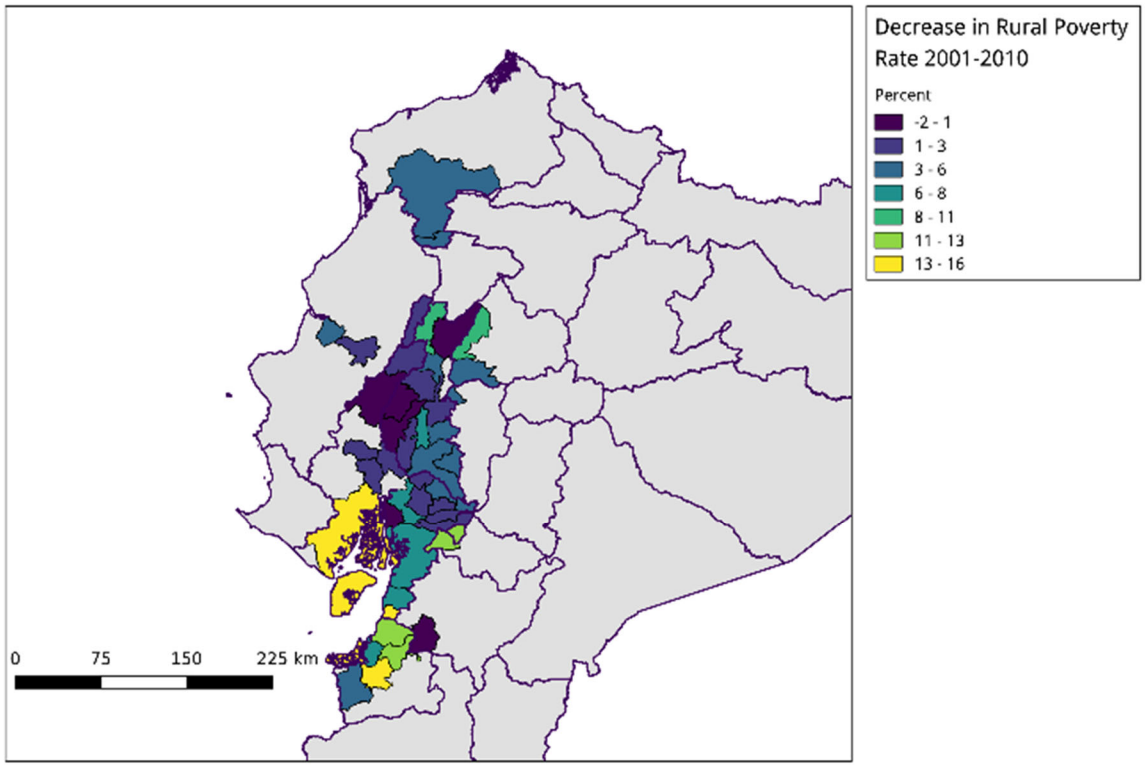
Poverty – by banana growing cantons 2010





Rate of improvement in poverty 2001-2010 – canton





S21. Social and political capital – Quantity of Training & Further Education of Workers

Indicator	Scope	Value	Data Source
Educational attainment / farm managers (% of respondents)	Ecuador/Banana farms in El Oro, Guayas, Los Rios provinces	Primary: 13% Secondary: 37% Undergraduate: 47% Postgraduate: 3%	2019 Banana Farm Survey (472 responses)

S21 shows educational attainment for farm management. The Farm survey also collected some preliminary data on training patterns and providers for field, packing, and office staff, which supports the need and desire for future technical training opportunities.

S22. Social and political capital – Right to Start & Form Trade Unions, Bargain Collectively

Indicator	Scope	Value	Data Source
Right To Start & Form Trade Unions, Bargain Collectively	Ecuador/national	Yes – Executive Order 193 (2017) reestablishes/ expands rights of social organizations, including unions	US State Department (2018)
Presence of worker organizations on banana farms	Ecuador/El Oro, Guayas, Los Rios provinces	10% of surveyed farms (2019)	2019 Banana Farm Survey

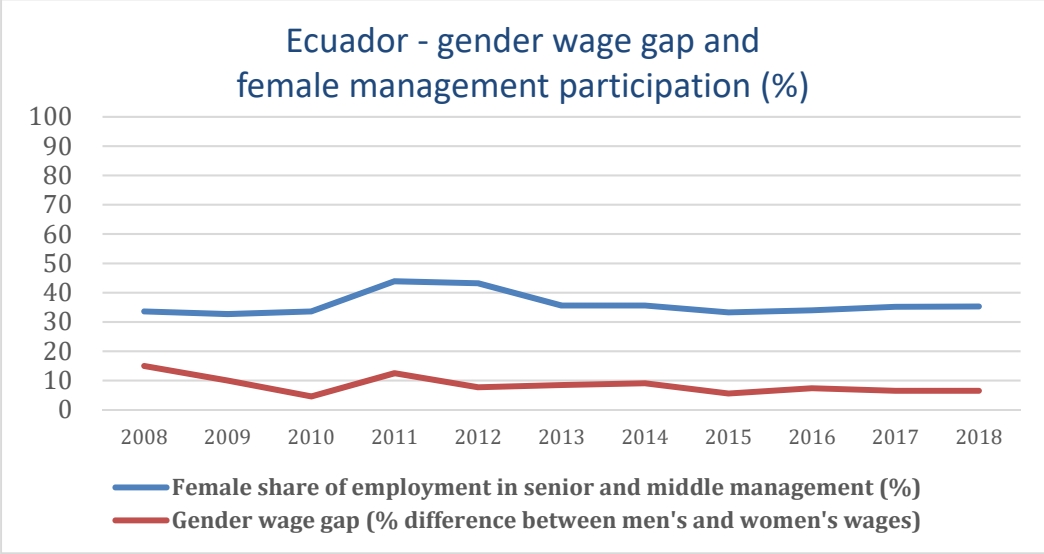
Source: https://www.state.gov/wp-content/uploads/2019/03/ECUADOR-2018.pdf
Source: https://www.elcomercio.com/uploads/files/2017/10/23/Decreto_No._193_20170923175846.pdf

While the right for labor to organize is granted under Ecuadorian law, worker organizations are not present on many banana farms in Ecuador. The organizations that are present are typically local worker organizations, and not tied with national unions.

ASSESSMENT RESULTS: PHYSICAL AND FINANCIAL CAPITAL

P1. Gender Wage Gap

Indicator	Scope	Value	Data Source
Gender wage gap (% difference between men's and women's wages)	Ecuador/national	7% (2018)	INEC
Gender wage gap (% difference between highest paid men and women's wages)	Ecuador/Surveyed banana farms in El Oro, Guayas, Los Rios provinces	17% (2019)	2019 Banana Farm Survey
Female share of employment in senior and middle management (%)	Ecuador/national	35% (2018)	INEC



The gender wage gap in Ecuador is relatively small, at a national level, and management participation fairly high. In the banana sector women's participation is lower and the wage gap greater than the national average.

P2a. Physical and Financial – Access to capital

Global Financial Inclusion (Global Findex) Database 2017

World, 2017

Source: Global Financial Inclusion (Global Findex) Database

	Global (154923)	Global %	Ecuador (1000)	% Ecuador	Ecuador-Respondents with Ag receipts (66)	% Ag receipts Group
Received agricultural payments in last 12 months	18,101	15%	66	7%	66	100%
Owns a mobile phone	127,777	82%	756	76%	48	73%
Has an account at a financial institution	92,925	60%	505	51%	46	70%
Has credit card	30,098	19%	82	8%	5	8%
Borrowed in the past year	73,971	48%	301	30%	36	55%
Borrowed from financial institution	*18,938*	*12%*	*105*	*11%*	*19*	*29%*
Borrowed from family/friends	*35,046*	*23%*	*121*	*12%*	*19*	*29%*
Borrowed from informal club	*5,901*	*36%*	*5*	*1%*	*1*	*2%*
Borrowed from Other source	*73,776*	*48%*	*106*	*11%*	*6*	*9%*
Borrowed for farm/business	10,426	7%	65	7%	18	27%
Loan from finance institution for home, apt, land	20,319	13%	72	7%	12	18%
Saved in the past year	78,401	51%	315	32%	30	45%
Saved in past 12 mos for farm/business	21,708	14%	125	13%	18	27%
Possibility of coming up with emergency funds	87,159	56%	404	40%	28	42%

The indicators in the 2017 Global Findex database are drawn from survey data covering over 150,000 people in 144 economies-representing more than 97 percent of the world's population
Source: Demirgüç-Kunt, Asli, Leora Klapper, Dorothe Singer, Saniya Ansar, and Jake Hess. 2018. The Global Findex Database 2017: Measuring Financial Inclusion and the Fintech Revolution. Washington, DC: World Bank. Ref: WLD_2017_FINDEX_v02_M. Accessed at [url] on [date]

P2b.

Indicator	Scope	Value	Data Source
Banana farms that have received a loan / % of those surveyed	Ecuador/Surveyed banana farms in El Oro, Guayas, Los Rios provinces	Rate: 55% (2019)	2019 Banana Farm Survey
Banana farms that have received a loan / Perceived difficulty	Ecuador/Surveyed banana farms in El Oro, Guayas, Los Rios provinces	Rate 3.4 (2019) (Scale of 1 to 5, 1 is very difficult and 5 is very easy)	2019 Banana Farm Survey

The Global Financial Inclusion index (P2a) gives an indication of how Ecuadorians compare regarding various financial considerations and access to capital. It doesn't call out banana farmers, but does allow to compare agricultural community members. P2b shows participation in the credit market specifically by banana farms, and also rates the difficulty of that participation – which had a fairly even distribution along the line from those who had difficult accessing credit to those who found it easy.

P3. Indicator: Investment in R&D

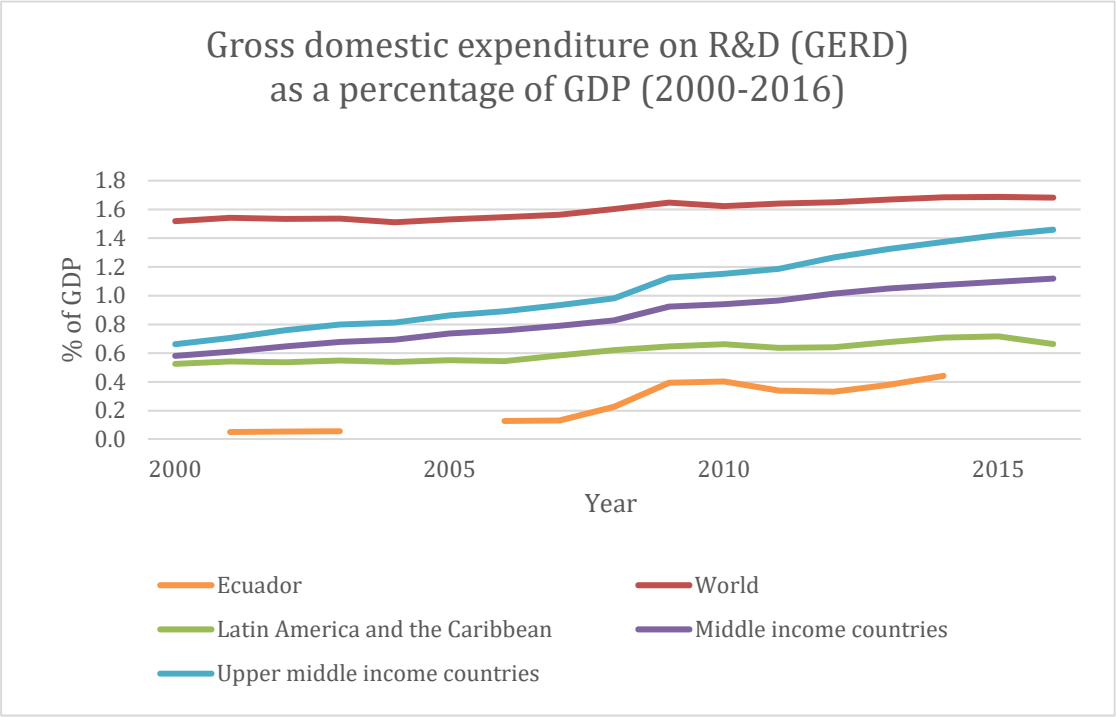
Indicator	Scope	Value	Data Source
Gross domestic expenditure on R&D (GERD) as a percentage of GDP	Ecuador/national	0.44 % of GDP (2014)	The World Bank
Ecuador: Gross domestic expenditure on R&D (GERD) / Agriculture and Veterinary Sciences	Ecuador/national	$30.3 M (2014)	The World Bank

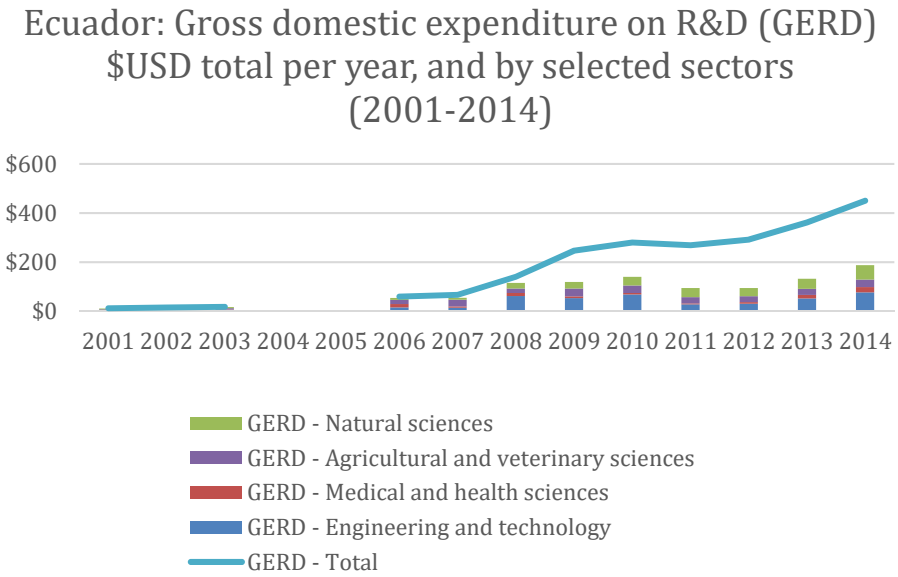
Source: https://data.worldbank.org/indicator/IP.PAT.RESD?end=2018&locations=EC&start=2012

Ecuador's investment in Research and Development is well below averages for Latin America and both Middle and Upper Middle income countries as a percentage of GDP, and investments specifically in agricultural research and the sciences are very small. Banana industry stakeholders also verbally indicated that investments in banana production and processes is extremely limited. There is a significant window for innovation that is currently not being filled – even minor increases in R&D

investment could have a significant impact on the banana industry. Similarly, the number of patent applications (P4) from Ecuador is extremely low and indicates additional innovation opportunity.

Trends:

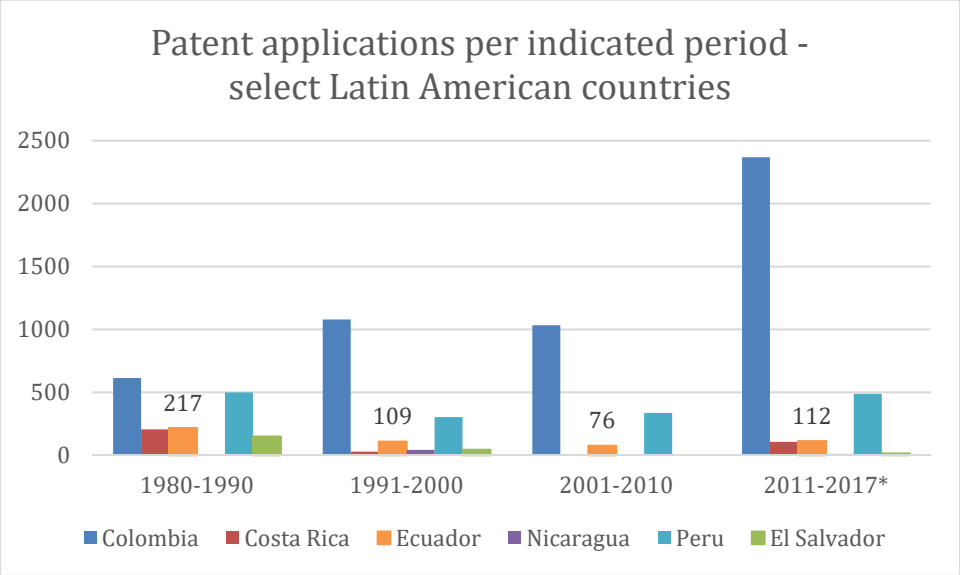




P4. Indicator: Patent applications

Indicator	Scope	Value	Data Source
Patent applications, residents	Ecuador/national	16 (2017)	The World Bank

Source: https://data.worldbank.org/indicator/IP.PAT.RESD?end=2018&locations=EC&start=2012



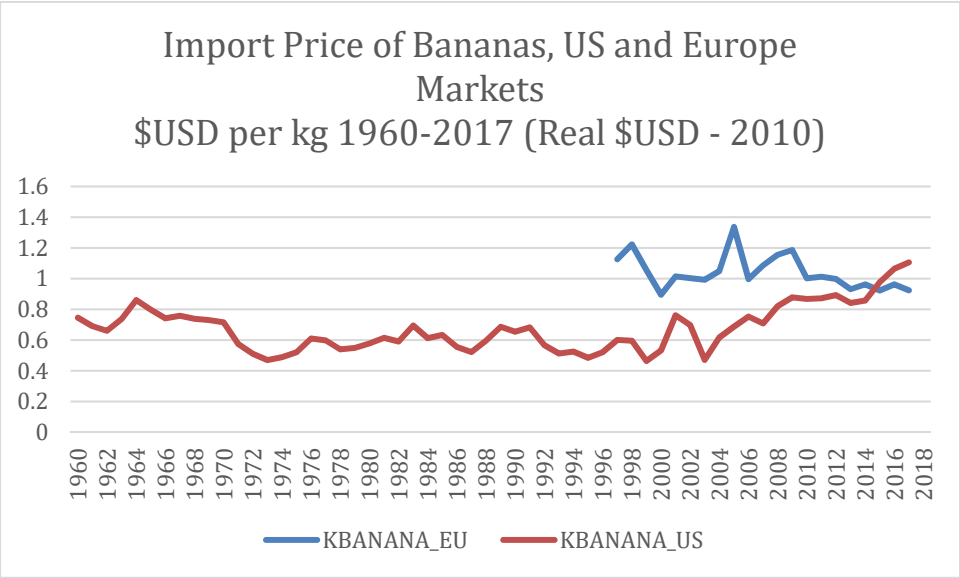
P5. Indicator: Banana price

Indicator	Scope	Value	Data Source
CPI Average Price Data, U.S. city average (AP)	Global	$ 0.569 per pound (Data extracted on: October 17, 2019 (3:38:02 PM) (Equivalent to $1.254 per kg)	US Department of Labor, Bureau of Labor statistics
Ecuador: Official banana price per box	Ecuador	$ 6.40 per box (2020) 1 Box = 41.5-43 pounds	Ecuador Ministry of Agriculture

Source: https://data.bls.gov/pdq/SurveyOutputServlet
Source: https://www.elcomercio.com/actualidad/mag-precio-caja-banano-exportacion.html

Discussion The global market prices are floating and changes often. The Ecuador official price is set for the year. It was raised from $6.30 per box in 2019 to $6.40 per box in 2020. There was some discussion on trying out separate in season and out of season prices, but that proposal does not appear to be going forward.

Trends:



https://www.worldbank.org/en/research/commodity-markets#1

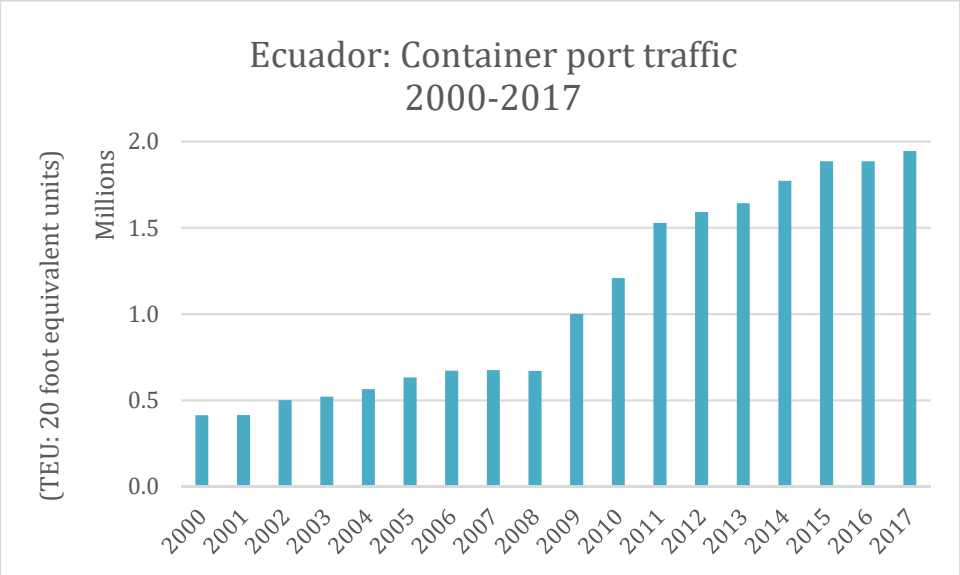
P6-P7. Indicator: Quality of port infrastructure

Indicator	Scope	Value	Data Source
Quality of port infrastructure, WEF	Ecuador/national	Score: 4.6 (2017) (1=extremely underdeveloped to 7=well developed and efficient by international standards)	The World Bank
Container port traffic	Ecuador/national	1.94 M (2017) (TEU: 20 foot equivalent units)	The World Bank

Source: https://data.worldbank.org/indicator/IQ.WEF.PORT.XQ
Source: https://data.worldbank.org/indicator/IS.SHP.GOOD.TU

Discussion: Ecuador opened a new deep water shipping port in 2019, which can take much larger ships than existing ports and provides a needed capacity expansion. It is expected that the World Bank's overall port quality and traffic indicators will increase with an updated assessment.

Port information: https://www.dpworldposorja.com.ec



P8. Physical and Financial Capital – Tax Rates

Indicator	Scope	Value	Data Source
Producer and Exporter Tax	Ecuador	Proportional rate: 1-2% of Gross Sales, (Beginning January 1, 2020)	SRI Ecuador
Producer and Exporter Tax	Ecuador	Flat tax rate: $0.4720 per kg of banana sold. (Through Dec 31, 2019)	SRI Ecuador

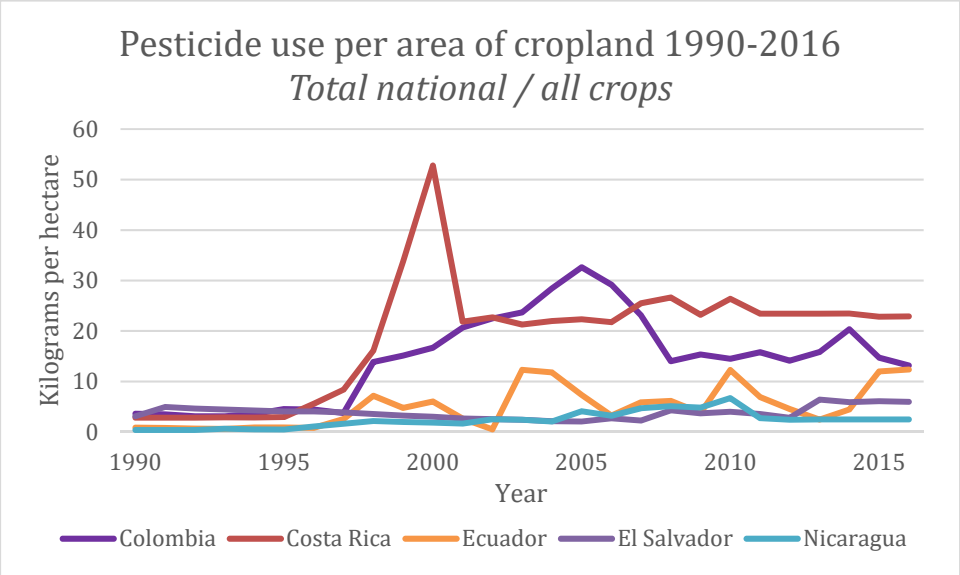
Source: https://www.sri.gob.ec/web/guest/ley-organica-de-simplificacion-y-progresividad-tributaria: https://www.ecuadortimes.net/tax-law-benefits-are-already-applicable-for-bananas-and-other-sectors/

Discussion: A new tax law was enacted at the end of 2019 for banana production, changing from the existing flat rate based on volume (by weight), to a tax based proportionally on gross sales, using a graduated sliding scale based on a farm's production scale (# of boxes), with lower rates for smaller production levels. The law also includes a potential 1% deduction for producers certified as having "Good Agricultural Practices". Banana exporters are taxed on the differential between sales price and the official price paid to producers – omitting potential double taxation that occurred under the flat tax.

P9. Physical and Financial Capital – Pesticide use

Indicator	Scope	Value	Data Source
Pesticide use per area of cropland	Ecuador/national-all crops	12.36 kg / Hectare of farmland (2016)	FAO (2019)

http://www.fao.org/faostat/en/#data/EP/visualize



Discussion: Pesticide use per area of cropland is a useful proxy for comparing among countries. However, which chemicals are used is typically more important than the quantity that is used, and industry chemical use trends are changing. It is acknowledged that this indicator is weak for the purposes of this assessment. Better data on chemical content, and also values specific to the banana industry would be desirable to access for future reviews of this topic. Ideally – national level data would show an average per hectare annual use of key pesticides/chemicals of interest, thus allowing individual farms to compare their operations to the average and also help target research and/or training programs to find alternatives or reduce use of more sensitive products. We were not currently able to access this more specific data.

P10. Physical and Financial Capital – Minimum wage

Indicator	Scope	Value	Data Source
Base salary (Salaria Basica Unificada)	Ecuador	USD $460 per month *(As of January 1, 2019 - base salary is $394 with 14 payments per year.)*	Ministry of Labor, Ecuador
Average employee salary / Large and medium banana farms (30 hectares and larger)	Ecuador/Surveyed banana farms in El Oro, Guayas, Los Rios provinces	USD $511 per month *(Average base salary is $438 with 14 payments per year.)*	2019 Banana Farm Survey (266 respondents)

Source: http://www.trabajo.gob.ec/incremento-del-salario-basico-unificado-2019/

Article 328 of Ecuador's constitutions requires that workers be paid a "salario digno", or a living wage that will cover the cost of basic necessities for workers and their families. The Base salary is adjusted annually and paid in 14 installments over the course of the year (monthly, plus 2 months with an extra payment.) In 2019, the base salary was $394 per payment, or $460 per month.

The 2019 Farm Survey collected average salary data. The data shows that a portion of the smaller farms hire laborers and temporary employees that receive hourly or day rates – but that the vast majority of employees receive the basic salary or higher.

ASSESSMENT RESULTS: NATURAL CAPITAL INDICATORS

N1. Natural Capital – Water Availability
Indicator:

- 1353 – Average Precipitation In Depth (Mm Per Year)

Dataset	Scope	Value	Data Source
Mean precipitation	Ecuador/national		WorldClim 2.0

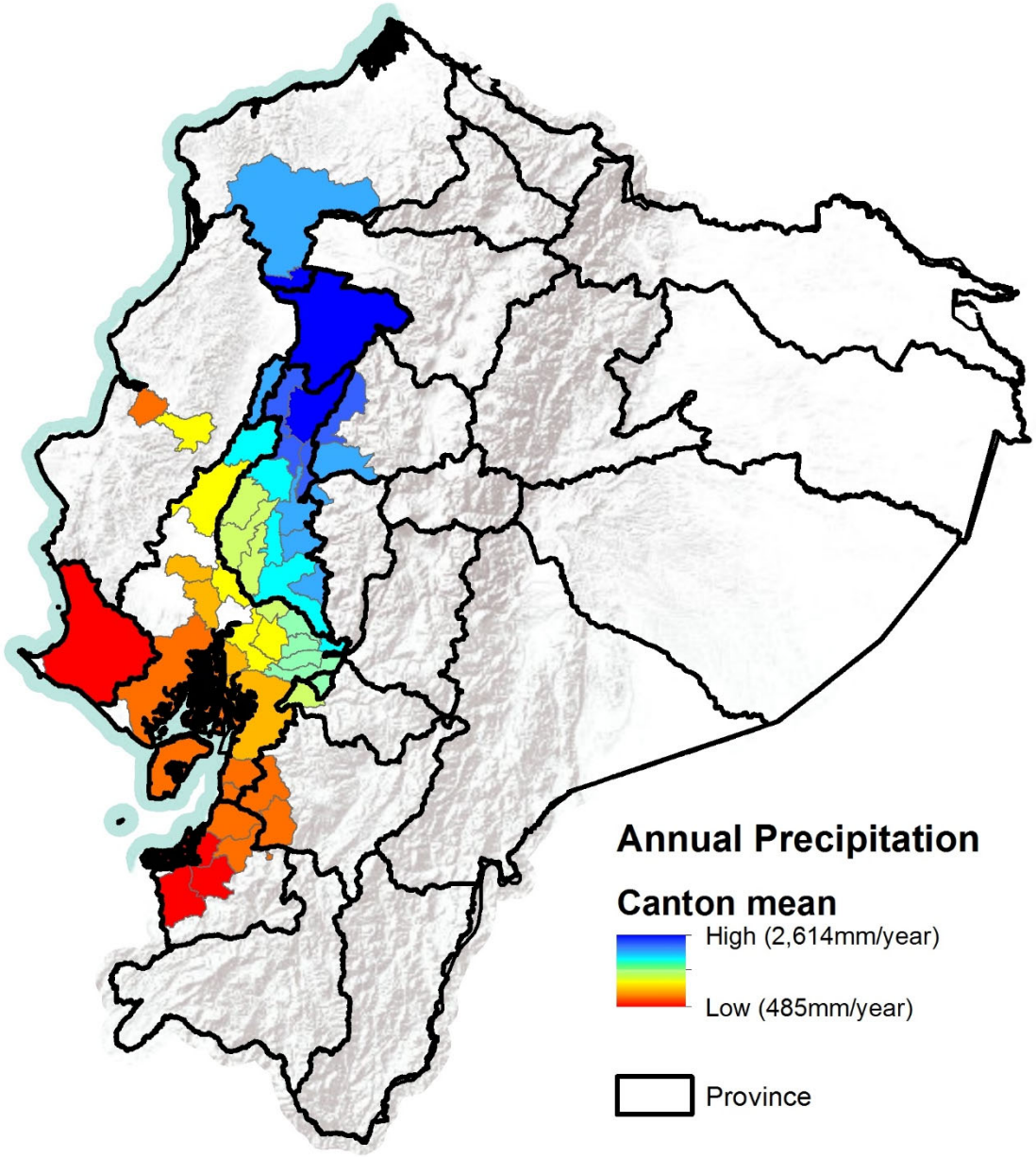
This rate is internationally comparable.

Background and discussion:

Water availability is an important sustainability issue in virtually all agricultural systems. Here, we track the mean precipitation rate across the banana region. Generally, approximately five times as much precipitation is found in the northern banana production zones than in the south.

Water availability in many agricultural systems is determined through a system of water rights and delivery infrastructure in addition to precipitation levels. Therefore, the data associated with this indicator do not represent the entire picture of the quantity of water available to banana growers. However, they may indicate those cantons that have either more tenuous current supplies or may be most sensitive to future changes in precipitation patterns.

Source: http://worldclim.org/version2



Annual mean precipitation.

Annual mean precipitation (mm/year), by canton.

Canton	Mm/year
Alfredo Baquerizo Moreno	1,589
Arenillas	503
Baba	1,582
Babahoyo	1,865
Balao	766
Balzar	1,352
Bolivar	1,314
Buena Fe	2,351
Camilo Ponce Enriquez	865
Crnel. Marcelino MaridueÃ±a	1,675
Daule	1,042
Duran	1,151
El Guabo	658
El Piedrero	1,763
El Triunfo	1,718
Empalme	1,884
Gnral. Antonio Elizalde	1,952
Guayaquil	701
La Concordia	2,575
La Mana	2,401
La Troncal	1,627
Las Naves	2,110
Machala	485
Manga del Cura	2,150
Milagro	1,423
Mocache	1,921
Montalvo	2,047
Naranjal	1,112
Naranjito	1,660
Palenque	1,604
Pangua	2,002
Pasaje	733
Pucara	792
Puebloviejo	1,895
Quevedo	2,199
Quininde	2,078
Quinsaloma	2,273
Salitre	1,226
San Jacinto de Yaguachi	1,282
Santa Elena	540

Santa Lucia	964
Santa Rosa	579
Santo Domingo	2,614
Simon Bolivar	1,730
Tosagua	759
Urdaneta	2,024
Valencia	2,573
Ventanas	2,050
Vinces	1,502

N2. Natural Capital - Diseases
Indicator:

- 575 – Damage Due To Diseases

Banana growers are currently able to control pathogens affecting banana plants in Ecuador through management practices and application of agricultural chemicals. If / when Fusarium oxysporum (Foc R4T) gets established in Ecuador, it is estimated that damage costs will be high. That figure will be calculated upon that occurrence—or if another major pathogen effects the crop that isn't already accounted for as part of normal management practices.

N3/N8/N10. Natural Capital - Biodiversity
Indicator:

- 678 – Decline In Species & Habitat Diversity
- 946 – Offtake of Given Species
- 991 – Harvest of Wood Products

Dataset	Scope	Value	Data Source
Natural land cover	Ecuador/national		MAGAP (2018)

Background and discussion:

Biodiversity is generally difficult to quantify with accuracy. While local surveys may provide information on presence and absence of plant and animal species, larger-scale (e.g. national) surveys have not been completed is most locations. The native biodiversity of the banana production zone in Ecuador has not been systematically surveyed, so a proxy dataset is needed to provide evidence of the status of biodiversity.

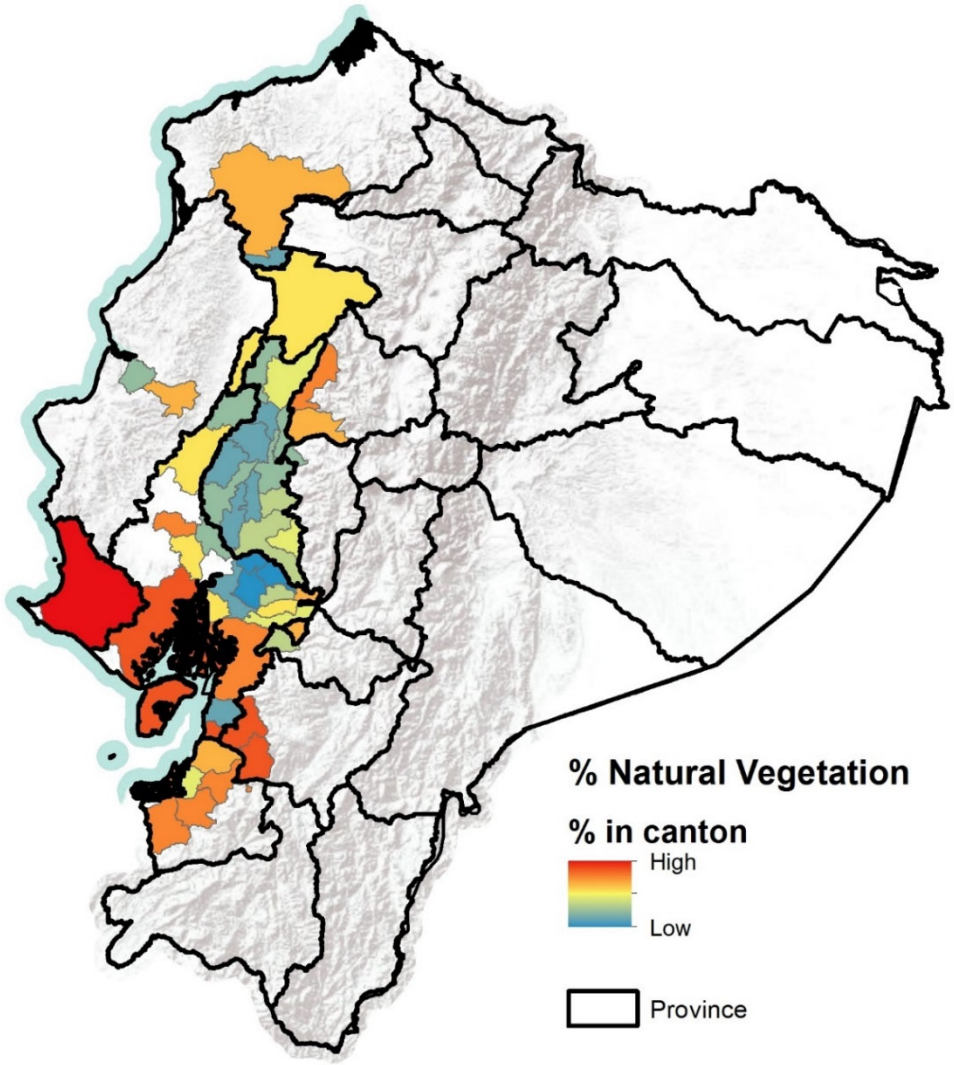
One such proxy is land cover, specifically the amount of natural land cover remaining in a given area. While land cover may not be directly equivalent to other species-focused biodiversity metrics, it does at least provide an estimate of likely biodiversity (see e.g. Seto et al. 2012).

Natural land cover ranged from 80.9% in Santa Elena Canton to 0.1% in Alfredo Baquerizo Moreno Canton. Ecuador in general is comprised of 62.0% natural land cover.

Because of existing land use laws, natural land cover is generally not being converted to new banana farms. The natural land cover metrics provided here then serve to describe land conversion that occurred over the past several hundred years. Future comparisons to this baseline then can be used to track restoration and habitat enhancement efforts by banana farmers (and others).

Source: MAGAP geodatabase (01_COB_USO_NACIONAL_NIVEL_MAPEADO)

Seto, K.C., B. Guneralp, and L.R. Hutyra. 2012. Global forecasts of urban expansion to 2030 and direct impacts on biodiversity and carbon pools. *Proceedings of the National Academy of Sciences of the United States of America*, 40:16083-16088.



Percent natural vegetation cover, by canton.

Percent of natural land cover ("Natural (%)"), by canton.
(49 banana producing cantons)

Canton	Area (ha)	Natural veg (ha)	Natural (%)
Ecuador (all)	24,898,393	15,434,005	62.0
Alfredo Baquerizo Moreno	21,862	31	0.1
Arenillas	80,613	23,194	28.8
Baba	51,703	676	1.3
Babahoyo	108,677	3,991	3.7
Balao	40,910	656	1.6
Balzar	118,747	16,725	14.1
Bolivar	53,823	10,515	19.5
Buena Fe	58,127	1,891	3.3
Camilo Ponce Enriquez	63,936	27,302	42.7
Crnel. Marcelino Maridue ├▒a	25,441	2,719	10.7
Daule	46,607	4,884	10.5
Duran	30,045	3,404	11.3
El Guabo	60,339	11,040	18.3
El Piedrero	17,019	3,873	22.8
El Triunfo	39,542	3,661	9.3
Empalme	71,593	2,323	3.2
Gnral. Antonio Elizalde	15,326	2,854	18.6
Guayaquil	411,167	232,448	56.5
La Concordia	32,428	458	1.4
La Mana	65,716	19,517	29.7
La Troncal	31,890	1,618	5.1
Las Naves	14,871	348	2.3
Machala	32,347	2,961	9.2
Manga del Cura	48,287	6,762	14.0
Milagro	40,549	126	0.3
Mocache	56,799	650	1.1
Montalvo	36,322	2,695	7.4
Naranjal	173,207	46,140	26.6
Naranjito	22,483	1,001	4.5
Palenque	57,959	717	1.2
Pangua	72,152	17,297	24.0
Pasaje	45,594	13,575	29.8
Pucara	58,509	26,592	45.5
Puebloviejo	33,548	448	1.3
Quevedo	30,464	364	1.2
Quininde	387,401	84,120	21.7
Quinsaloma	28,298	687	2.4
Salitre	39,343	896	2.3

San Jacinto de Yaguachi	50,945	550	1.1
Santa Elena	360,155	291,386	80.9
Santa Lucia	35,768	11,316	31.6
Santa Rosa	81,067	23,931	29.5
Santo Domingo	344,614	37,514	10.9
Simon Bolivar	29,160	59	0.2
Tosagua	37,605	1,030	2.7
Urdaneta	37,850	1,677	4.4
Valencia	97,794	7,640	7.8
Ventanas	53,129	1,182	2.2
Vinces	69,649	1,868	2.7

N4. Natural Capital – Climate Change
Indicator:

- 1254 – Emissions Of Greenhouse Gases

Dataset	Scope	Value	Data Source
Energy sources / % of surveyed farms	Ecuador/ Banana farms in El Oro, Guayas, Los Rios provinces	Irrigation - Diesel: 86% - Gas: 7% - Electricity: 7% Packing house - Diesel: 30% - Gas: 20% - Electricity: 50% (December 2019 / 459 farms.)	2019 Banana Farm Survey

Currently, a majority of irrigation is powered by carbon-based fuels (95%) as well as half of packing house operations (50%). There are initiatives getting started to expand the use of electric energy for these purposes to cut down on both air and noise pollution and increase efficiencies. We can expect to see the balance shift going forward. It will be good to monitor progress for this shift towards greener energy options.

N5, N12. Natural Capital – Natural Disasters
Indicator:

- 482 – Extreme Climate Events (Floods & Droughts)
- 758 – Water Availability, Trend, & Uses

Dataset	Scope	Value	Data Source
Modeled climate change	Ecuador/national		IPCC (ccsm4 rcp85)

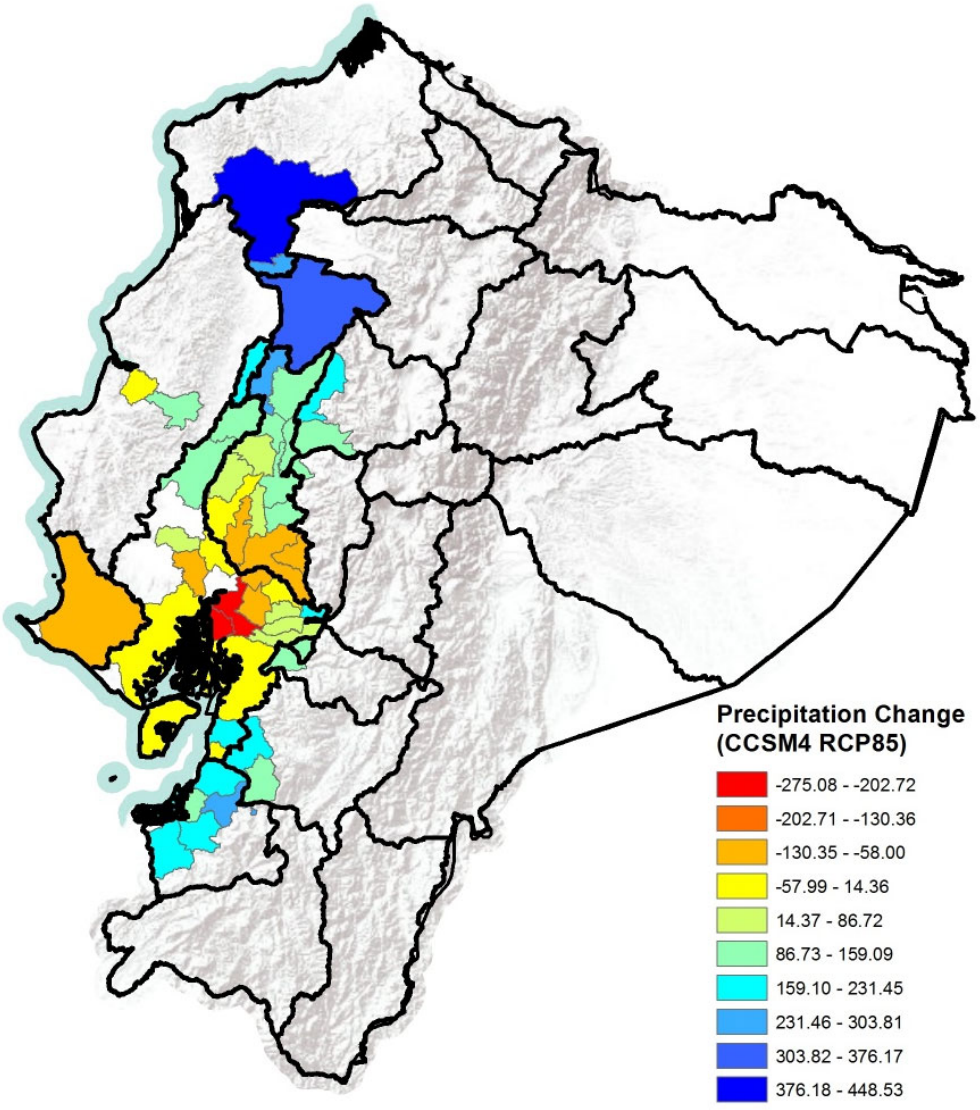
This rate is internationally comparable.

Background and discussion:
While the overall global mean temperature is rising, potential future changes to temperature and precipitation patterns on a regional scale will be heterogeneous. Generally warmer temperatures will affect global circulation patterns so that some areas will get wetter, and others drier, even within a local area. These changing precipitation patterns have the potential to increase both drought and flood risks.

Climate change modeling relies on many variables and assumptions. As a result, there are multiple models and emissions scenarios available for assessing likely climate futures. Once commonly used model is CCSM, which we have selected for this report. The model selected is associated with the RCP85 emissions scenario.

This model predicts that, within the banana production zone, the northern cantons will likely receive greater precipitation (up to approximately 450mm/year) while the southern cantons will receive less (up to a loss of 275 mm/year). The cantons expected to see the greatest increase are those that already receive the most precipitation, while the already drier cantons will likely see the greatest reduction. One exception to this pattern is El Oro province, which is anticipated to see a modest increase in yearly precipitation.
If this pattern of future climate change is accurate, there will be a greater likelihood of flooding in the north and a commensurate increase in drought potential in the south.

Source: http://www.cesm.ucar.edu/models/ccsm4.0/



Modeled change in precipitation by year 2100.

Canton	Δ Precipitation (mm/year)
Alfredo Baquerizo Moreno	-110.4
Arenillas	193.6
Baba	-103.9
Babahoyo	-76.7
Balao	183.6
Balzar	111.7
Bolivar	116.2
Buena Fe	262.6
Camilo Ponce Enriquez	189.0
Crnel. Marcelino MaridueÃ±a	21.8
Daule	-79.2
Duran	-275.1

El Guabo	223.9
El Piedrero	155.6
El Triunfo	24.1
Empalme	126.5
Gnral. Antonio Elizalde	197.7
Guayaquil	-43.3
La Concordia	272.5
La Mana	186.4
La Troncal	109.8
Las Naves	88.2
Machala	109.3
Manga del Cura	213.3
Milagro	-94.5
Mocache	71.2
Montalvo	-62.3
Naranjal	-23.6
Naranjito	15.9
Palenque	34.9
Pangua	133.0
Pasaje	257.9
Pucara	136.9
Puebloviejo	17.4
Quevedo	103.8
Quininde	448.5
Quinsaloma	97.0
Salitre	-48.3
San Jacinto de Yaguachi	-219.1
Santa Elena	-90.4
Santa Lucia	82.3
Santa Rosa	189.0
Santo Domingo	359.7
Simon Bolivar	-30.6
Tosagua	-37.1
Urdaneta	123.6
Valencia	126.9
Ventanas	94.6
Vinces	-15.8

N6. Natural Capital – Fragmentation
Indicator:

- 316 – Fragmentation Of Habitats

Dataset	Scope	Value	Data Source
	Ecuador/national		MAGAP (2018), FRAGSTATS

Background and discussion:
Biodiversity can be greatly affected not just by the quantity of habitat loss but also by the spatial pattern of that loss (Fahrig 2003). Fragmentation of habitats can prevent the movement of plants and animals across a landscape thereby restricting access to vital resources, blocking migration, and preventing access to new habitats.

Natural habitat in the banana regions of Ecuador are not just greatly reduced from historic conditions but are also highly fragmented, posing difficulty for use of the remaining habitat by native species. This spatial habitat pattern is the result of several hundred years of intensive land use in the region; there is currently little additional fragmentation occurring.

There is currently an opportunity to reduce fragmentation in the banana region through implementation of habitat enhancement in buffer zones around the banana farms and other strategic locations. Well-coordinated efforts could result in reduced fragmentation through linking existing and newly established natural areas into habitat networks.

One metric that can be used to measure future efforts in this regard is “patch cohesion”, a measure of fragmentation that can be calculated using FRAGSTATS software. Testing of fragmentation metrics shows that patch cohesion is one of the better metrics for predicting animal movement through landscapes.

Source: https://www.umass.edu/landeco/research/fragstats/fragstats.html

Fahrig, L. 2003. Effects of habitat fragmentation on biodiversity. *Annual Review of Ecology Evolution and Systematics*, 34:487-515.

N7. Natural Capital – Climate Change
Indicator:

- 246 – Global Mean Temperature Rise

Dataset	Scope	Value	Data Source
Annual mean temperature	Ecuador/national		NASA/GISS

This rate is internationally comparable.

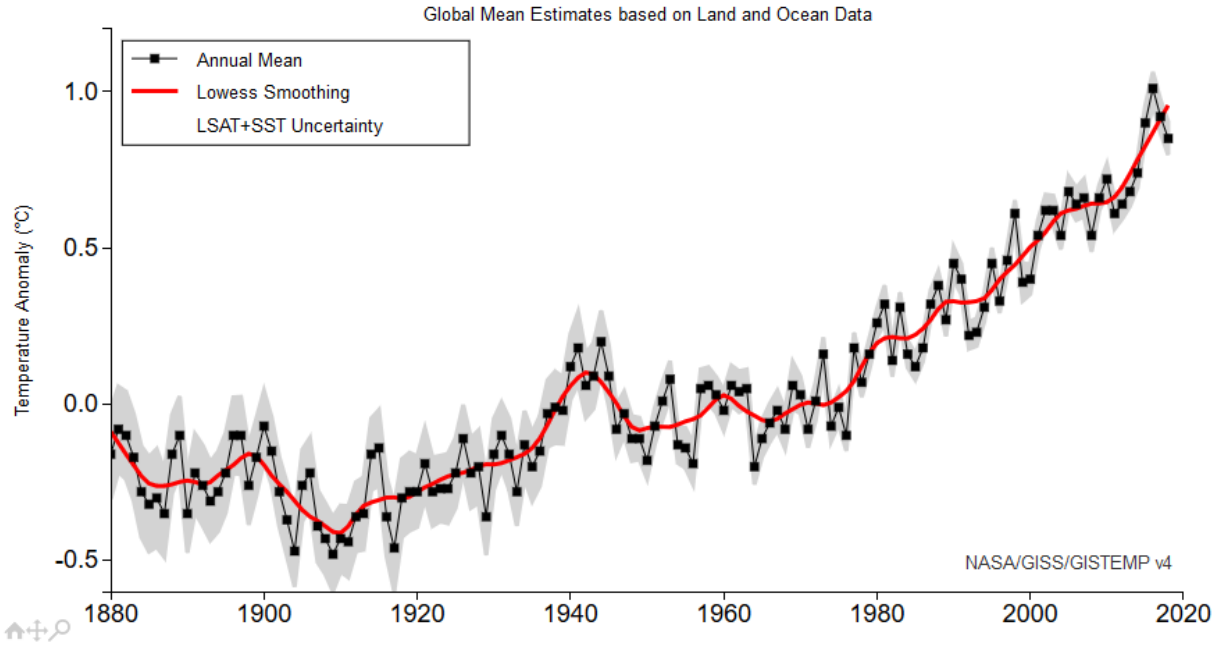
Background and discussion:

The global mean temperature has been rising for the past century. This trend has increased in the past 50 years. The changing temperature has had and will have many impacts on natural and human systems across the planet (see e.g. Hansen et al. 2010). This includes increasing variability in temperature and precipitation patterns in more localized areas.

Bananas in Ecuador, like most agricultural systems, is likely to be affected by these changes in pattern. Tracking global mean temperature will provide information on increased vulnerability of the industry as a result.

Source: https://data.giss.nasa.gov/gistemp/

Hansen, J., R. Ruedy, M. Sato, and K. Lo. 2010. Global surface temperature change. *Reviews of Geophysics*, 48.



Land-ocean temperature index, 1880 to present, with base period 1951-1980. The solid black line is the global annual mean and the solid red line is the five-year lowess smooth. The gray shading represents the total (LSAT and SST) annual uncertainty at a 95% confidence interval. [More information on the updated uncertainty model can be found here: Lenssen et al. (2019).]

Global mean temperature change since year 1880. Graph taken from Goddard Institute for Space Studies (National Aeronautics and Space Administration).

N9. Natural Capital – Flooding, Salinity

Indicator:

- 1530 – Land Area Where Elevation Is Below 5 Meters

Dataset	Scope	Value	Data Source
Digital elevation model	Ecuador/national		CIAT (SRTM data version 4.1)

This rate is internationally comparable.

Background and discussion:

Low elevation, coastal areas are most at risk from possible flooding and saltwater intrusion. This characteristic will be exacerbated under future climate change through increases in high precipitation events (Trenberth et al. 2003) and rising sea levels (Nicholls and Cazenave 2010).

A global metric of this risk is land that is less than 5.0 meters above current sea level.

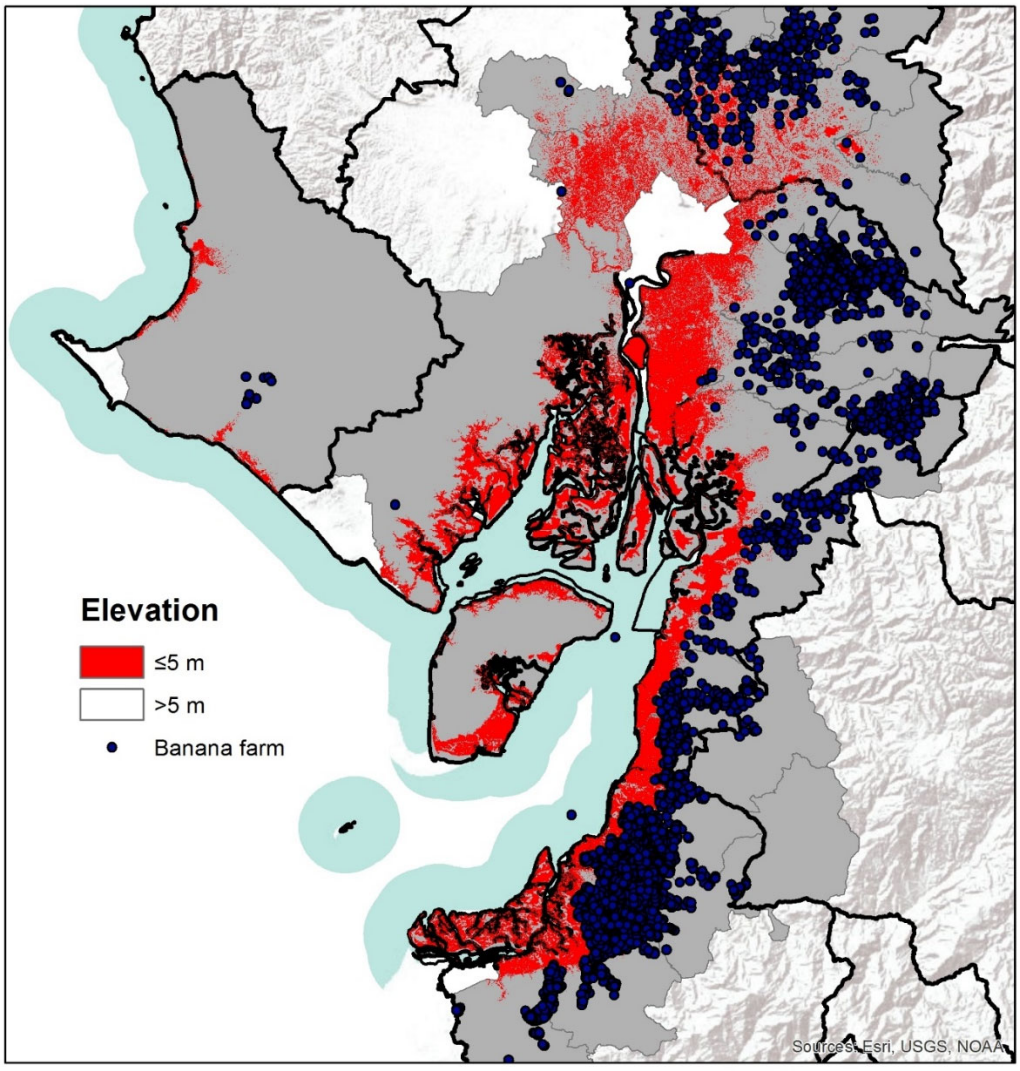
CIAT has developed a global digital elevation model (DEM). This relatively high-resolution dataset allows the identification of these at-risk areas in Ecuador's banana production region. The dataset can be used to identify farms most at risk as well areas that would be most risky in which to establish new farms.

Generally, current banana production in Ecuador occurs on land that is higher than the 5-meter line. One exception though is some low elevation farming in El Oro province. The area just north of Machala contains a number of farms that are comprised of land with less than 5-meter elevation. These farms are mostly likely to be at risk from rising sea levels. Additionally, there are farms north of Guayaquil that are far enough inland that there may not be future sea level problems, but could be likelier to experience flooding from sources such as Babahayo River.

Source: http://srtm.csi.cgiar.org/

Nicholls, R.J., and A. Cazenave. 2010. Sea-level rise and its impact on coastal zones. *Science*, 328(5985):1517-1520.

Trenberth, K.E., A. Dai, R.M. Rasmussen, and D.B. Parsons. 2003. The changing character of precipitation. *Bulletin of the American Meteorological Society*, 84(9):1205-1217.



Banana farms in proximity to low elevation coastal areas.

N11. Natural Capital – Wastes & Pollution

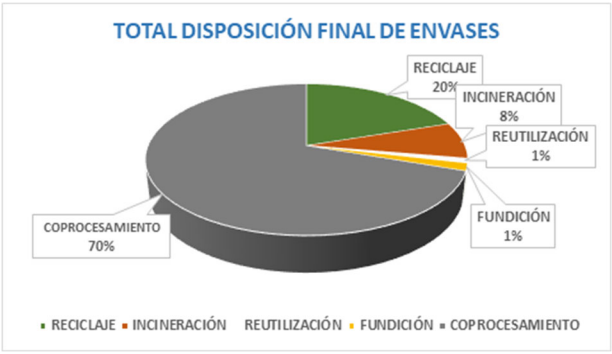
Indicator: 1252 – Waste Recycling & Reuse

Dataset	Scope	Value	Data Source
Waste management practices / % of surveyed farms	Ecuador/ Banana farms in El Oro, Guayas, Los Rios provinces	Paper & cardboard - Return to vender: 74% - Recycle facility: 10% - Send to dump: 1% - Reuse: 12% - Burn: 2% Plastic containers - Return to vender: 70% - Recycle facility: 20% - Send to dump: 1% - Reuse: 6% - Burn: 3% Other plastics: - Return to vender: 65% - Recycle facility: 22% - Send to dump: 1% - Reuse: 6% - Burn: 3% Agricultural chemicals - Return to vender: 87% - Recycle facility: 7% - Send to dump: 2% - Reuse: 1% - Burn: 2%	2019 Banana Farm Survey (December 2019 / 459 farms.)

On recycling plastics:

Banana farms are required by law to have a recycling and waste management plan in place as part of the farm registration process. Innovagro is one of two major groups in Ecuador coordinating the recycling of agricultural containers. Since their program began in 2007, Innovagro has recovered 1,600 tons of plastic containers, 80% which comes directly from the banana industry. The other group working to recycle agricultural containers is APCSA, which imports the majority of agrochemicals into Ecuador. APCSA began similar recycling practices in 2012.

The two graphics below summarize Innovagro's plastics recycling activities:



N13, N14. Natural Capital – Water Quality
Indicator:

- 761 – Water Quality - Evidence Of Pollutants
- 1878 – Water Quality: Nutrients

Dataset	Scope	Value	Data Source
Pollutant Concentration in Guayas River Basin	Ecuador/ Guayas River Basin	% of sites contaminated: 60% (108 of 181 sampling sites) # Pesticide products indentified: 26	DeKnock et, al 2018
Perceptions of irrigation water quality	Ecuador/ Banana farms in El Oro, Guayas, Los Rios provinces	Rank: 4.6 (Scale of 1 to 5, 1 being very dirty, 5 being very clean)	2019 Banana Farm Survey (December 2019 / 459 farms.)

Background and discussion:
Agricultural production can lead to impacts on water quality through use of pesticides and fertilizer. These impacts can in turn lead to human health concerns for downstream users as well as harm to aquatic biota.

The banana industry in Ecuador uses both pesticides and fertilizer to maintain production. A sustainable production system will result in levels of these pollutants to not exceed safe standards. Research done by DeKnock, et al published in 2018 showed that "pesticide contamination of the freshwater environment was widely present in the Guayas river basin with detections at 108 sampling sites (60%). A total of 26 pesticide products were identified at significant levels. Most frequently detected pesticides included cadusafos (62 locations), butachlor (21 locations) and pendimethalin (21 locations), with concentrations up to 0.081, 2.006 and 0.557 μg·L−1 respectively. Pesticide residues detected in this study did not significantly influence the biological water quality ($p = 0.69$), but were observed to be positively correlated with ammonium concentrations, supporting the assumed combined application of chemical fertilizers and pesticides in agriculture. These pesticide residues were also associated with one or more agricultural crops, with in particular the banana and rice industries identified as major pollution sources."

Many of the contaminants identified in this study are not commonly used in banana production. Of the pesticides correlated with banana production, Cadusafos has the highest potential for negative effects downstream due to its longevity in aquatic systems (Deknock et al. 2018). We recommend installing systems to measure chemicals runoff from farms as well as installing a network of monitoring sites throughout the river systems in banana production (and other) areas that could be established and maintained by the national government.

There was a long-term monitoring network of the Guayas River System and a broad array of sites throughout Ecuador that appears to have been discontinued in the 1980's, with the exception of one site remaining in the Amazon basin. The huge advances in sensor technology over the last few years should enable the resumption of long-term monitoring of freshwater systems at very low cost. Ecuador's shrimp industry may provide a potential resource for current sensor technology that can collect data and also raise alarms if specific thresholds are met.

Source:

Deknock, A., N. De Troyer, M. Houbraken, L. Dominguez-Granda, I. Nolivos, W. Van Echelpoel, M.A. Eurie Forio, P. Spanoghe, and P. Goethals. 2018. Distribution of agricultural pesticides in the freshwater environment of the Guayas river basin (Ecuador). *Science of the Total Environment*, 646:996-1008.

Conclusions and recommendations

This assessment that is being finalized in fall 2020 takes place in a very different world than was present at the beginning of this effort in 2018 and 2019. The questions, concerns, and data analyzed in this document largely reflect the world prior to the global COVID-19 pandemic, and the report, itself, has been partially delayed due to the chaos and uncertainty. Ecuador, the United States, and most of the world were unprepared for COVID-19. The impacts have been large and are still ongoing for the foreseeable future. Economies are still contracted worldwide, and the tolls on our populations have been severe. As of September 2020, Ecuador has lost over 11,000 people to COVID-19 – almost 8% of those diagnosed with the disease have died. The US has lost over 200,000 people to the pandemic – equal to almost 3% of those diagnosed in the US.

Within this difficult context, this assessment's purpose remains to highlight progress made over the last two decades and to identify continued challenge areas for Ecuador's banana sector. Knowing how our context has and will continue to change, we will not go back and rewrite each section of the assessment to reflect COVID impacts, as the existing data we document here are largely unchanged. But we can expect the positive trajectories on many human and social issues we have enjoyed over the past decade to potentially slow or reverse over the next period, as our societies begin to recover from both the health and economic impacts of the pandemic.

That said: the banana industry in Ecuador has accomplishments to be proud of, and tremendous opportunity to make additional progress in a number of areas going forward.

As previously mentioned: priority topics identified through the stakeholder engagement process (broadly) include:

- Environmental footprint of the industry, including land and water impacts, and chemical use
- Labor / worker wages and safety, and impacts on the community
- Economic policy (including global markets)
- Risk factors, including climate change and TR4 virus

On environment, the banana industry's impact on the landscape is largely historical – the moratorium on the expansion of banana groves means that direct deforestation through installing banana plantations occurred years if not generations ago, and that current forest impacts and potential deforestation stem primarily from inputs for shipping materials and plant support materials. These challenges are being addressed by many through purchase of certified sustainable forest products for these inputs and purchase of forestry offsets to provide compensation for past deforestation. However, our research posits that there remains tremendous opportunity to ameliorate past habitat loss in the banana regions and improve connectivity and biodiversity through strategic use, planting, and linkage of habitat networks within the mandated buffer zones around roads, waterways, and community areas. One can envision significant support from the international environmental community for undertaking this type of effort. Potential indicators to track for this type of effort would include implementation of

connectivity pathways, natural landscape/conservation plantings, and ultimately measures of changes in biodiversity in restored/linked areas, which could also potentially improve natural pest management opportunities for the banana plantations and reduce costs of maintaining these buffer zones.

Regarding water, at this point, Ecuador's location in the tropics supports ample water supply, and the quantity of the resource does not seem to be in peril, unless climate change predictions come back much drier in the coming decades. Producers report good quality of irrigation water, albeit community water supplies are not always as clean as desired. The primary negative impact from the banana industry on water systems comes through contamination from agrichemical use, and to a lesser degree, through packing operation wastewater. Several studies documented contamination in the Guayas River basin, some of which is attributed directly to the banana industry. However this contamination has not caused permanent harm to riparian ecosystems. That being said, some of the chemicals identified are cumulative – which means that they continue to build up over time, and addressing their presence sooner is better. Bananas are just one of many agricultural industries contributing to this trend in this river basin. It will be important for the national government to improve monitoring and better identify point sources of contaminants to ameliorate agricultural contamination of rivers systems. Some of the certification programs require on-farm water monitoring – but 20% of farms surveyed in the 2019 Banana Farmer Survey are not part of any certification programs. And 30% of farms surveyed report that they do not filter or treat their waste packing water. Packing water has lower contaminant content than field wastewater and overspray – but is a fairly simple problem to address, and improving filtration and processing of packing water could be an immediate improvement at a relatively low cost.

Chemical use is comprised of two major factors: the concentrations of specific chemicals used, in total, and the number of applications. Total concentration can impact how much is absorbed in both food products, farm workers, and by the environment, and the number of spray cycles relates the number of pathways for human exposure to chemicals. We have documented average number of spray cycles on over 450 farms through the 2019 Farmer Survey, and note that there is a very wide diversity of management strategies for aerial spraying of banana groves to control Sigatoka. Additional training on best management strategies, and also broader incorporation of integrated pest management techniques, could greatly improve efficiencies. One important metric we were unable to document is average annual use per hectare of key agrichemicals used in banana production. Ecuador has a climactic competitive advantage for managing many pests and sharing this pesticide-use information as a national and/or regional average could both help individual producers improve their chemical use efficiencies, and also showcase Ecuador's advantage over other production regions.

Ecuador has strong laws in place addressing labor, worker wages, and the community, and a relatively high minimum wage established as a living wage, or "salario digno", with health safety networks in place, even if they are severely stretched during the COVID pandemic. Poverty rates in banana growing regions have steadily declined at faster rates than the national average. Efforts to eradicate child labor in the banana sector in the past 20 years have led to significant achievements, to the point that human rights organizations are no longer highly focused on this issue for Ecuador. Current regulatory and

inspections frameworks are needed to continue to address and document continued success on this front, and also promote additional improvements, such as related to the recent requirement for lactation sites on banana farms, and other initiatives.

While it is difficult to predict future global markets and economic trends, Ecuador's experiment with a set price for exports combined with support for small producers seem to successfully provide a margin of safety for producers, while giving the country as a whole more bargaining power in the marketplace. The recent tax policy revision, changing to a proportion of sales instead of a flat rate, is positive for the industry.

Key risk factors or vulnerabilities that have been identified through this assessment process include risks associated with disease such as TR4 and COVID, which can potentially be prepared for but often are not, and impacts associated with climate change, including potentially changing weather patterns, more unpredictable and severe storms, and sea level rise which could cause some banana farms to be contaminated by salinization, and could also impact transportation and port operations. Expanding genetic diversity of banana stock is an underdeveloped research area that could allow for more resilience against pests and disease. Ecuador's investment in research is very low for its relative GDP, and there are a number of potential targeted research programs that could enhance sustainability of the sector.

Overall, while the banana sector in Ecuador has some vulnerabilities and areas for improvement, it remains an important and robust component of Ecuador's economy and identity, and correlates with a wide array of social and economic improvements over recent periods.

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