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*Experiences of integrating agriculture in sectoral
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Colombia: advancing monitoring and evaluation of adaptation in the agriculture sector

Contents

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Highlights

↗ Colombia has developed an adaptation monitoring and evaluation (M&E) system, *the Sub-system on Information on Vulnerability, Risk and Adaptation* (SIIVRA), which includes agriculture.

↗ A vulnerability and risk analysis for the agriculture sector, based on a methodology of the Third National Communication, was carried out to identify 66 indicators, both existing and new, to measure hazards, sensitivity and adaptative capacity in the agriculture sector.

↗ The indicators are based around 18 prioritized value chains and will be used by the agriculture sector, territories at local level, and the private sector, in particular producers´ associations, to guide planning and investment on adaptation.

↗ The M&E of adaptation is built on a solid theoretical approach, downscales data to municipal level and has already been used in selection of adaptation measures.

↗ Challenges include integrating the indicators into agriculture sector reporting systems, strengthening capacities and clarifying institutional roles and responsibilities, including in data collection, storage and analysis.

↗ Key recommendations and next steps include: enhancing capacities on M&E and data gathering at local level; integrating and applying adaptation indicators throughout the agriculture sector´s planning cycle to guide decision-making and investment; and maintaining active engagement with the private sector, in particular in prioritized value chains, as adaptation M&E in the agriculture sector is rolled out.

Case study objectives

This case study provides an overview and analysis of lessons learned in developing monitoring and evaluation (M&E) of adaptation in the agriculture sector in Colombia, as part of a broader national adaptation M&E system. It presents the policy and institutional context for adaptation M&E in Colombia; the process, theory and methodology applied for designing the adaptation M&E system and in particular its agriculture components; and the outcome, or the vulnerability and risk analysis, and the indicators, that have been identified for assessing adaptation in the agriculture sector. Finally, lessons learned in terms of challenges, successes and next steps are discussed.

Context

Plans and policies on climate change adaptation

Colombia has a strong policy and legal framework in place to implement adaptation action. A Law on Climate Change (*Ley de Cambio Climatico* 1931/2018) gives legal importance to the issue and sets institutional arrangements and planning guidance. The National Climate Change Policy (Politica Nacional de Cambio Climatico, 2017) identifies low carbon rural development plans, which include climate resilient agriculture and reduced deforestation, as a strategic priority. It also states the need to generate and disseminate agro-climatic information that enables the development of climate resilient agriculture. A National Strategy on Information for Managing Climate Change (Estrategia Nacional de Información para la Gestión del Cambio Climático), under the climate policy, guides the development and implementation of information systems for delivering policy objectives and encompasses monitoring and evaluation (M&E).

Under the overall national climate policy, Colombia also has a National Adaptation Plan (*Plan nacional de adaptación al cambio climático* – PNACC, 2012) which provides a national approach to adaptation and leaves thematic priority setting to sectoral and territorial adaptation plans. It recognizes the importance of adaptation M&E systems. A climate change plan for the agriculture sectors (Plan Integral de Gestion del Cambio Climatico del Sector Agropecuario - PIGCSS, 2020, to be launched) has been developed identifying sectoral goals, strategies and priority actions. The PIGCSS has a strategic priority on generating climate change information, which includes a priority action on designing and implementing a monitoring, reporting, verification and evaluation system on climate change in the agriculture sector.

In addition, Colombia´s first nationally determined contribution (NDC, 2018) also identifies prioritized adaptation actions by 2030 which include: a national system of adaptation indicators that allows for M&E of adaptation measures; agriculture as a priority sector; 10 priority agricultural sub-sectors (or value chains) and agricultural producers associations; and production of agro-climatic information. Colombia submitted its updated nationally determined contribution (NDC) in December 2020 which includes enhanced targets, and it is considered one of the most ambitious in the Latin America and Caribbean region thus far, and is much more closely aligned with the country's objective of achieving carbon neutrality by 2050. Agriculture and the land use, land-use change and forestry (LULUCF) sector sector are consistently represented in both adaptation and mitigation sections, confirming their relevance for the country. Particular emphasis is placed on the Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+) programme and forestry-related activities as well as livestock and crops with associated NAMAs (for example coffee, panela).

Institutional arrangements for climate change adaptation and M&E

Colombia has a National Climate Change System (*Sistema Nacional de Cambio Climatico* – SISCLIMA) that was created by decree (298 – 24 February 2016) to coordinate, formulate and evaluate policies, plans, programs and actions in climate change adaptation and mitigation that are cross-sectoral and multi-stakeholder in nature, and relevant from national to departmental level.

An inter-institutional climate change commission (Comision Interseccional de Cambio Climatico- CICC) oversees the work of SISCLIMA and implementation of the National Climate Change Policy. It is formed of several sectoral ministries, including the Ministry of Agriculture and Rural Development (*Ministerio de Agricultura y Desarrollo Rural* - MADR) that implements

climate change priorities within the agriculture sectors. There is a working group for adaptation M&E, *Mesa de Monitoreo y Evaluacion Adaptacion* and a national technical working group on climate change and agriculture, which includes the country´s departments and representatives of agricultural producers' associations.

Climate information and M&E systems

Colombia has a National System for Evaluating Management and Results (Sistema Nacional de Evaluación de Gestión y Resultados – SINERGIA), which focuses on evaluating the implementation of the National Development Plan, into which sector level reporting and indicators feed into. An Environmental Information System (Sistema de Informacion Ambiental de Colombia – SIAC) coordinates environmental information across sectors, disciplines and institutions, led by the Ministry of Environment and Sustainable Development (*Ministerio de Ambiente y Desarrollo Sostenible* – MADS).

A Climate Change Information System (*Sistema Nacional de Informacion sobre Cambio Climatico* – SNICC), mandated under the Law on Climate Change and under SIAC, is being set up and is overseen by the Institute of Hydrology, Meteorology and Environmental Studies (*Instituto de Hidrologia, Meteorologia y Estudios Ambientales* - IDEAM). The SNICC includes sub-systems on: M&E of adaptation; monitoring, reporting and verification (MRV) of mitigation; and tracking climate finance. The Sub-system on Information on Vulnerability, Risk and Adaptation (*Sub-Sistema Integrador de Información sobre Vulnerabilidad, Riesgo y Adaptación* - SIIVRA) will support M&E of adapation under SNICC.

SNICC's M&E system for adaptation, which includes agriculture, has been in development since 2015, aiming to monitor: NDC commitments; implementation of the National Policy on Climate Change as well as sectoral and territorial strategies; efficiency of implemented actions and projects; impact of adaptation measures; and effectiveness of investments. A set of national adaptation indicators are being developed including for agriculture and food security. A protocol will identify relevant climate information and climate threats, develop methodologies and outline key actors for gathering, processing, storing and using information.

The system is based on a multi-dimensional analysis of climate change risk. It builds on the conceptual framework of risk put forward in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2014) as demonstrated in Figure **1**. The figure shows how the risk of climate-related impacts is a result of interaction between climate-related hazards and the vulnerability and exposure of human and natural systems. Socio-economic factors and inequities have a significant influence on differences in vulnerability and exposure.

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Figure 1

IPCC conceptual framework of risk
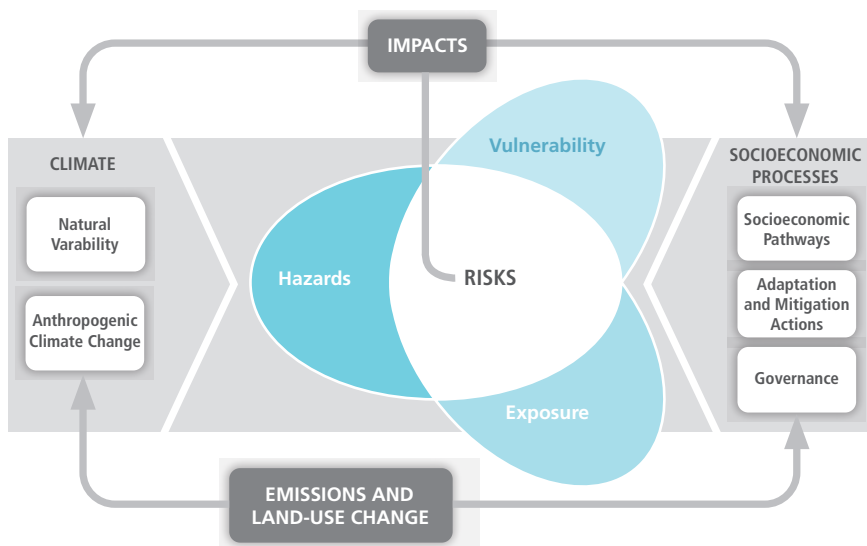
Source: IPPC, 2014.

The M&E system aligns with the theoretical approach adopted by Colombia´s Third National Communication (TNC) to the United Nations Framework Convention on Climate Change (UNFCCC), (IDEAM, 2017). In addition to the dimensions of risk described in Figure 1, the TNC also added a dimension of adaptive capacity. The formula used for assessing climate risk is shown below.

Formula for calculating climate risk under the adaptation M&E system of Colombia

Climate change risk = Hazard (exposure) x Vulnerability (sensitivity ÷ adaptive capacity)

The TNC developed 113 adaptation indicators for assessing vulnerability and risk in six priority areas (food security; water resources; biodiversity; health; human habitat; infrastructure). These were further classified into hazards, sensitivity and adaptive capacity indicators.

Box 1

Basic contextual information on the country, sect or area of study, climate change impacts

Climate scenarios predict an increase of temperature of around 1°C by 2040 in Colombia, whilst patterns of rainfall vary from decrease to increase depending on the region (IDEAM et al, 2017). In the Third National Communication (IDEAM et al, 2017), food security is identified as the priority area most at risk from the impacts of climate change, due to high exposure and sensitivity of agricultural production to climate change and variability, and low national adaptive capacity (such as lack of agricultural insurance and access to technology).

Agriculture represents around 6% of of the gross domestic product (GDP) in Colombia (World Bank, 2020) and is recognized as one of the fastest growing economic sectors, especially for commercial agriculture, livestock and fisheries (DANE, 2020). Coffee, sugar cane and palm oil are all likely to be highly impacted by climate change (IDEAM, 2017). Coastal areas and fisheries will be affected by rising sea levels, soil erosion and salinity (IDEAM, 2017). Small-scale and subsistence farmers are likely to be hardest hit (IDEAM, 2017).

1. The process

The NAP-Ag project committee, which includes representatives of MADR, FAO and UNDP, agreed on a workshop to initiate adaptation M&E activities in the agriculture sector in June 2018. A team of national experts from IDEAM, who had worked on the TNC, were hired to carry out research and provide technical guidance on the M&E process.

A workshop on *Monitoring and evaluation of adaptation to climate change in the agriculture sector* was held in Bogota, in October 2018. It was attended by 25 participants from government, including MADR, MADS, IDEAM and Department of Planning (*Departamento Nacional de Planeacion* DNP); government institutes; and several agricultural producers' associations (for coffee, rice, livestock, sugar cane, cereals, bananas, pig farming, forest industry and banking). The workshop brought together key actors to give technical guidance; review and identify potential indicators; and map sources of information for an M&E system for adaptation in the agriculture sectors.

Following the workshop, the team of experts carried out an analysis of climate-related vulnerability and risk in the agriculture sector in Colombia (FAO, UNDP, IDEAM, 2020), which enabled the identification of vulnerable areas, crops and species for the sector, and the development of a set of adaptation indicators.

A rapid analysis of institutional capacities on adaptation of ten national producers' associations was carried out on request of the government, as an input to the ongoing NDC revision. It enabled the measurement of progress on Colombia´s NDC (2018) adaptation action on 10 priority

agricultural sub-sectors (or value chains) and agricultural producers associations. The analysis focused on specific value chains, assessing capacities with regards to gathering and using climate information, planning and implementing adaptation, and M&E. The analysis found that M&E was one of the most challenging components of adaptation planning for several sub-sectors (FAO, 2020). Capacity was assessed from 1 out of 5 (for the potato sub-sector, represented by MADR in the survey) up to 4.8 out of 5 (for the sugar cane sub-sector, represented by Colombian Association of Sugar Cane Producers), with all sub-sectors achieving an average score of 3 out of 5. The rapid analysis will enable the establishment of a baseline against which to measure progress of sub-sectors in M&E of adaptation.

The next steps in Colombia´s M&E of adaptation in the agriculture sectors entails integrating developed adaptation indicators in the national M&E system, SIIVRA, and into MADR's own planning cycle. The indicators will measure risk and vulnerability and guide planning and investment in the agriculture sector at large within MADR at sector level, within territories at local level, and by key partners, in particular agricultural producers' associations. This process will contribute to Colombia´s adaptation commitments for the agriculture sector put forward in its NDC (2020).

Results and outcomes

The vulnerability and risk analysis for the agriculture sector (FAO, UNDP, IDEAM, 2020) was developed applying the methodology of IDEAM, also used in the TNC. It used historical climate data (1975–2005) and climate scenarios for 2011-2100, downscaled to municipal level. It also built on the relevant priority areas already developed under the TNC, namely: food security; water resources; and biodiversity. The analysis looked at the agriculture sectors as a whole, which included agriculture, forestry, livestock and aquaculture. 18 value chains for analysis on hazards were prioritized, as shown in Figure 2. These value chains were chosen based on analysis and data developed by the Planning Unit for Rural Farming (Unidad de Planificacion Rural Agropecuaria – UPRA) for key national value chains, to which climate change data and scenarios could be applied.

Figure 2

IPCC conceptual framework of risk
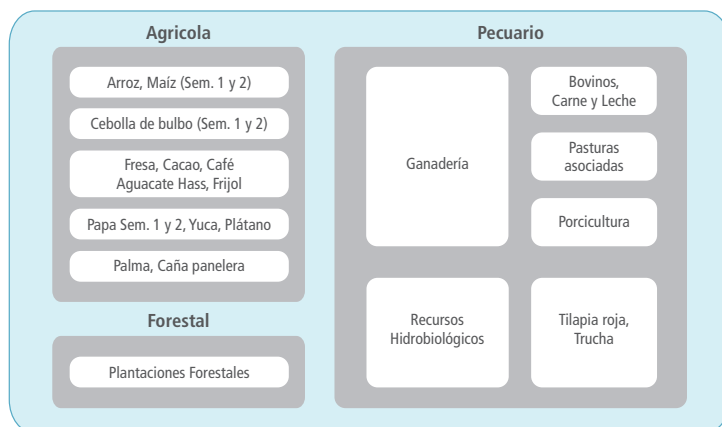
Source: IPPC, 2014.

A total of 66 indicators were chosen: 28 for hazards; 23 for sensitivity; and 15 for adaptive capacity, as show in Table 1. The majority of indicators used (45 indicators) were taken from the 113 indicators of the TNC. An additional 21 indicators were tailored or added for the purpose of measuring vulnerability and risk specifically in the agriculture sector, adding for example the fisheries sub-sector. Indicators were chosen based on a set of criteria, which had already been applied for the TNC, namely: availability of information for the required time period/baseline; data availability down at departmental, and ideally municipal scale and local engagement in data collection; official data, measured annually or bi-annually (IDEAM, 2017).

For each indicator, a source of data, means of calculation, frequency of measurement and use have been identified.

Table 1

Indicators by dimension/type

Dimensions	Hazard	Vulnerability	
		Sensitivity	Adaptive capacity
Food security: crops; forestry; aquaculture and fisheries; livestock	16	12	8
Water	5	7	3
Biodiversity	6	11	4

Source: **FAO and UNDP.** 2018. *Report on the Workshop on M&E of adaptation in the agricultural sector (not published).*

The 28 hazard indicators measure in particular change in available areas for optimal agro-climatic growth zones of 13 crops; aquaculture (for 2 species); forestry (for forest plantations and palm oil); cattle (beef, milk and pastures); and pig farming (see Table 2). They also measure change in availability of water for agricultural use and fisheries, and changes in forest cover and natural vegetation. 21 indicators were directly from the TNC, whilst 7 additional ones were chosen to measure additional prioritised crops/value chains.

Table 2

**A sample of adaptation indicators for agriculture sector in Colombia**

Indicator type	Example indicators
Hazard	• Change in surface area of optimal agro-climatic zone for 18 priority crops and species (1 per species/crop) • Estimated change in supply/demand of water for fisheries/agricultural use • Change in forest cover/natural vegetation
	• Percentage of area covered by insurance • Percentage of coffee/aquaculture/forestry GDP of total departmental (GDP) • Severity of extreme monetary poverty • Agricultural areas with soil erosion/salinization • Aridity index • Women only in charge of production • Area under land-use conflict in agricultural zones • Total number of people affected by natural hydrometeorological and climatic events by department • Number of landslides/floods by department • Percentage of municipal land area affected by abnormal/below average rainfall • Index on hydrological pressure on ecosystem/on water not returning to watershed/on hydrological retention and regulation • Percentage of area of municipality covered by forest/by natural ecosystem • Degree of change in wetlands in Colombia
Adaptive capacity	• Degree of agricultural technical assistance received by agricultural production unit • Number of agricultural production units with soil conservation measures/ with crop rotation/ with subsistence fishing/ with livestock rotation / with irrigation for agriculture/ with protection of water sources / with rainwater harvesting • Credits disbursed by department by agricultural surface area • Investments in food security and nutrition • Number of producers who are not members of associations • Percentage of municipality with registered protected area coverage • Index on water use efficiency • Areas under family/small-scale agriculture

Source: **FAO and UNDP.** 2018. *Report on the Workshop on M&E of adaptation in the agricultural sector (not published).*

For each value chain, hectares lost, gained or consistent are calculated and charted, based on hazard indicators and against climate projections for 2040. This enables the identification of optimal areas for production based on areas remain optimal, which ones lose significance, which new areas become optimal. This can guide decision-making and investments. This data has been mapped down to municipal level as shown in Map 1.

Map 1

National map of threats to Hass Avocado
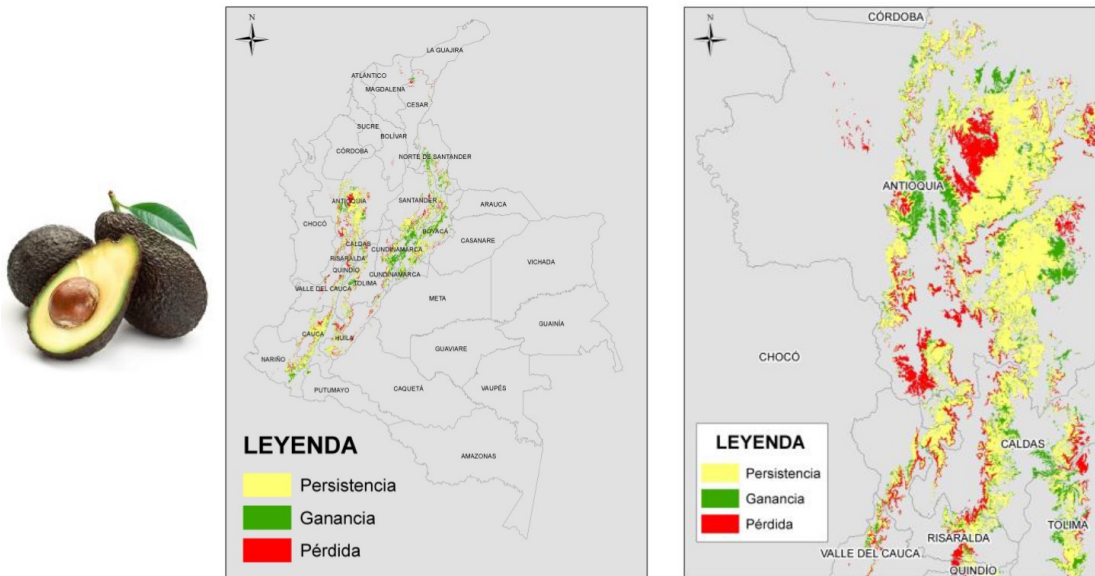
Source: **FAO and UNDP.** 2020. *Análisis de vulnerabilidad y riesgo por cambio climático en el sector agropecuario en Colombia (not published).*

The boundaries and names shown and the designations used on these map(s) do not imply the expression of any opinion whatsoever on the part of FAO or UNDP concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers and boundaries. Dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

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The sensitivity indicators (see Table 2) that build largely on existing data and indicators of the TNC (for 16 indicators in total) measure issues such as areas under agricultural insurance, portion of agriculture in GDP at regional level, poverty, aridity, people or areas affected by floods/landslides/high rainfall. They also measure ecosystem degradation (such as areas covered by forests and natural ecosystems) and availability of water (such as water flows/regulation). Additional indicators to the TNC (7 in total) were included for measuring such as areas with soil erosion and salinity, production by women, conflicts in land use and changes in wetlands. The analysis found that the north zone of country is highly sensitive; as is the central zone which is the main agricultural zone.

For the adaptive capacity indicators (see Table 2), 5 indicators were chosen from the TNC which measure for example agricultural extension support/technical assistance, credit by agricultural area, public investment in food security, water efficiency use and protected area coverage. A total of 10 new indicators, in particular to measure adaptation practices, include: number of soil conservation practices; membership in agricultural producers' associations; livestock rotation; subsistence fisheries; irrigation; water conservation; rainwater harvesting; family farming. The analysis found that low adaptive capacity is constant across the country, largely due to lack of extension support and low use of water in agriculture.

The majority of data used were indicators already being measured, including through statistics and census data. Table 3 summarises the key data sources.

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Table 3

Data sources for measuring adaptation indicators in agriculture sector

Institution/data source	Type of data used
IDEAM	Climate change scenario Representative Concentration Pathways (RCP) 6.0 for 2040; water, biodiversity (vegetation cover, ecosystems) and soil (degradation by salinity and erosion) data
Unit of Rural and Agricultural Planning, MADR (UPRA)	Zoning of agricultural systems; agricultural frontiers
Agrosavia (Colombian corporation for agricultural research)/ICA (Colombian Agricultural Institute)/ Finagro (Fund for Agriculture Sector Financing)	Optimal temperature and precipitation ranges for productive systems
Aunap (national authority for aquaculture and fisheries)	Fish and aquaculture production data
Sustainable Livestock Round Table	Livestock and grassland data
DANE (National Department of Statistics)	National agriculture survey: socio-economic information; crop production practices
DNP	Socio-economic information; institutional information by municipalities

Source: **FAO and UNDP.** 2018. *Report on the Workshop on M&E of adaptation in the agricultural sector (not published).*

Data was correlated and indicators adjusted for analysis (including positive/negative indicators). This spatial and numeric data was used to measure indicators and calculate a value by municipality for each of the following: hazards; sensitivity; adaptive capacity; and indexes for risk and vulnerability. The values are provided on a scale of: very low; low; medium; high; and very high. National maps were generated, with data downscaled to municipal level. Map 2 shows an example of climate risk mapped by municipality. Risk was calculated as a formula of hazard and vulnerability (see Map 2 below).

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Map 2

Data sources for measuring adaptation indicators in agriculture sector
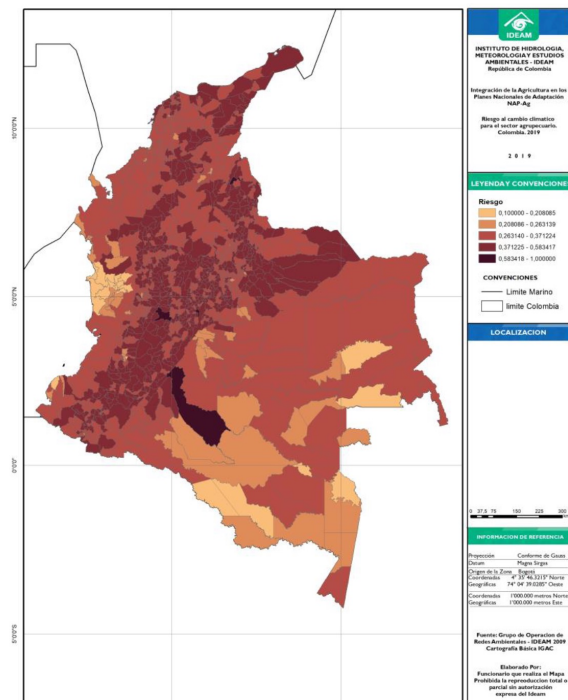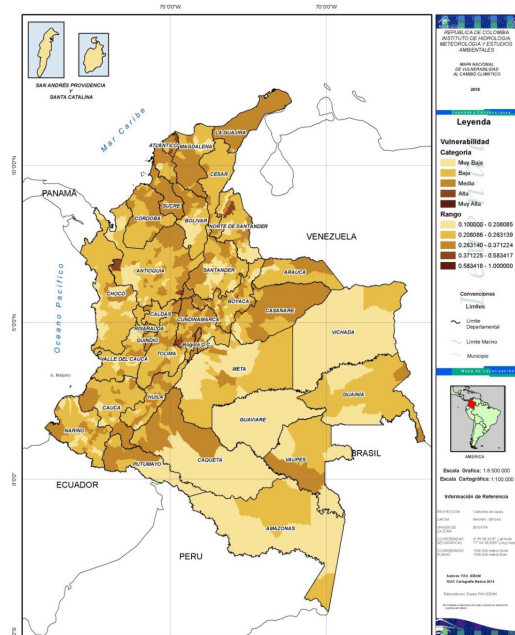

Source: **FAO and UNDP.** 2020. *Análisis de vulnerabilidad y riesgo por cambio climático en el sector agropecuario en Colombia (not published).*

The boundaries and names shown and the designations used on these map(s) do not imply the expression of any opinion whatsoever on the part of FAO or UNDP concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers and boundaries. Dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Vulnerability was calculated as sensitivity **divided** by adaptive capacity. This was shown as highest for the north of the country, as demonstrated in Map 3.

Map 3

National map of vulnerability in the agriculture sector

Source: **FAO and UNDP.** 2020. *Análisis de vulnerabilidad y riesgo por cambio climático en el sector agropecuario en Colombia (not published).*

The boundaries and names shown and the designations used on these map(s) do not imply the expression of any opinion whatsoever on the part of FAO or UNDP concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers and boundaries. Dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Lessons learned

Colombia has a strong legal and policy framework for supporting M&E of adaptation, which has territorial and sectoral coverage and includes the agriculture sector. The national climate change system SISCLIMA, governance arrangements such as CICC and the climate information system SNICC and SIIVRA, provide a clear framework and entry point for strengthening agriculture-specific M&E of adaptation. The Colombian approach is built on a solid theoretical background, including research done under the TNC, and is focused on using existing data already gathered by various national institutions. Results of the vulnerability and risk assessment in the agriculture sector have already been used to guide selection of some of the adaptation measures prioritised in the Climate Change Plan for the Agriculture sector. The agriculture sector has been leading the development of a national adaptation M&E system in Colombia and the M&E work has strengthened the institutionalisation of reporting in the sector. It has also provided an opportunity for enhancing collaboration between the environment and agriculture sectors.

A key challenge includes defining how to integrate information systems, including incorporating agriculture-relevant indicators under SIIVRA into MADR´s own reporting system. Information will need to be systematized and capacities strengthened to implement M&E of adaptation across the agriculture sector, from national to local levels within MADR, as well as with key partners such as agricultural producers' associations. Governance and institutional agreements on roles, for example, in data collection, storage and analysis will need to be defined both within MADR and with external partners and other ministries.

It has been challenging combining data for multiple indicators from multiple data sources, including across geographical scales. Measuring indicators within set agricultural zones and municipalities can also be difficult, when certain natural resource and ecosystem functions cross defined territorial boundaries of measurement.

Recommendations and next steps

- **Enhance capacities on M&E and data gathering at local level**

The agriculture indicators of SIIVRA are designed down to municipal scale and as such already provide valuable numeric and geographic data at local level. However, rolling out the indicators and M&E system at local level will require further work.

A workshop on M&E of adaptation in the agriculture sector is planned at community level, to strengthen capacities in M&E, use of tools and data gathering. Colombia has received support for these two activities from the NDC enhancement facility.

- **Integrate and apply adaptation indicators throughout agriculture sector´s planning cycle to guide decision-making and investment**

The developed adaptation indicators for the agriculture sector can be applied to evaluating the impact of on-going adaptation measures. The information produced by the vulnerability and risk assessment can help identify priority programmes and areas, including for value chains, and guide investments and decision-making on adaptation and risk management in the agriculture sector.

A key next step includes integrating the information and indicators developed under the risk and vulnerability assessment for the agriculture sector into SIIVRA, in collaboration between IDEAM and the Ministry of Environment.

- **Maintain active engagement with the private sector, in particular in prioritised value chains, as adaptation M&E in agriculture sector is rolled out**

The rapid capacity assessment, which involved the private sector in monitoring their adaptation capacities, proved to be a good strategy for strengthening NDC ambition, accelerating implementation, mobilizing business-driven climate action and addressing key barriers to private sector NDC implementation.

The private sector, and producers´ associations in particular, should be actively involved throughout the implementation of the agriculture-specific adaptation indicators of SIIVRA.

This emerging M&E work will help strengthen adaptation action and fulfil NDC commitments at national, agriculture sector and local levels in Colombia, including with key partners in private sector such as agricultural producers' associations.

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Further information

Guidelines:

- UNFCCC National Adaptation Plan – Technical guidelines for the National Adaptation Plan process (2012)
- Addressing Agriculture, Forestry and Fisheries in National Adaptation Plans – Supplementary guidelines (2017)
- Addressing forestry and agroforestry in National Adaptation Plans – Supplementary guidelines (2020)
- Addressing fisheries and aquaculture in National Adaptation Plans – Supplementary guidelines (2020)

Contacts:

↗ **United Nations Development Programme (UNDP)**
www.adaptation-undp.org/naps-agriculture

↗ **Food and Agriculture Organization of the United Nations (FAO)**
www.fao.org/in-action/naps

↗ **German Federal Ministry for Economic Affairs and Climate Action (BMWK)**
https://www.bmwk.de/Navigation/EN/Home/home.html

↗ **International Climate Initiative (IKI)**
www.international-climate-initiative.com

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- https://www.fao.org/in-action/naps/partner-countries/colombia/en/
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