Outcome Harvesting: Assessment of the transformations generated by Local Technical Agroclimatic Committees
In Latin America

Working Paper No. 299
CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

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About CCAFS working papers

Titles in this series aim to disseminate interim climate change, agriculture and food security research and practices and stimulate feedback from the scientific community.

About CCAFS

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Photos: CIAT (2019); INSIVUMEH (2019); CIAT (2018); CCAFS (2018).

Photo: Technical Agroclimatic Committee in Boyacá – Colombia. CIAT (2019)

Abstract

During 2019, an analysis process was carried out on the transformations generated by Local Technical Agroclimatic Committees (Mesas Técnicas Agroclimáticas-MTA in Spanish) in the territories where they have been established in the last six years. The study focuses on observable changes in communities, organizations, or institutions that have modified their actions, relationships, policies, and practices in four Latin American countries. Five transformation areas have been identified: i) greater confidence in the quality of climate and agroclimatic information at the local level; ii) enhanced knowledge, understanding, and connection of agroclimatic information; iii) democratization of climate knowledge; iv) transformations in agricultural practices, and v) political advocacy and institutional transformation. Over 140 outcomes or changes were verified in those areas. It has become evident that the MTAs analyzed have encouraged a closer approach of national meteorological institutions to the needs of territories, which in turn has promoted the creation of local practice communities on the application of climate knowledge in decision-making. Indeed, there is evidence that farmers adapt their production practices making decisions based on information on local climate variability, reducing losses and increasing profitability. It has also been shown that that the development of inter-institutional alliances derived from MTAs in the countries helps to build and strengthen local and national public policies for adaptation to climate change and variability in agriculture. Finally, several opportunities and challenges related to leadership and the sustainability of the MTAs establishment process in Latin America were identified.

Keywords

Agriculture; climate change; climate services; climate variability; adaptation.

Acknowledgments

In the last seven years, over 266 institutions in Honduras, Colombia, Guatemala, Nicaragua, El Salvador, Panama, Paraguay, Mexico, Ecuador, and Chile have adopted the Local Technical Agroclimatic Committees (MTAs in Spanish) approach as a mechanism to reduce agroclimatic risks. So far, we have a network of 39 MTAs and we would like to thank these institutions for their contributions in the departments of Córdoba, Sucre, Cauca, Boyacá, Magdalena, Cesar and La Guajira, Santander, Nariño, Tolima, Caldas, and Putumayo in Colombia; El Paraíso, Comayagua, Intibucá, the western region, the Gulf of Fonseca region, Santa Bárbara, and Olancho in Honduras; Estelí, Somotillo, and Madriz in Nicaragua; Chiquimula, El Progreso, Zacapa, Quiché, Huehuetenango, San Marcos, Totonicapán, Quetzaltenango, and center-south region in Guatemala; San Miguel in El Salvador; Itapúa and San Juan Misiones in Paraguay; Veraguas, Herrera, Los Santos, and Coclé in Panama; Chiapas in Mexico; Manabí in Ecuador; and the O'Higgins region in Chile.

In the preparation of this document, we would particularly like to thank all interviewees from MTAs leading institutions, the extension services, researchers, academia, farmers, and other stakeholders who have contributed to the use of this approach with their participation, invaluable comments, and suggestions.

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Contents

Introduction

The Local Technical Agroclimatic Committees (MTAs in Spanish) approach started under the auspices of a project financed by the Ministry of Agriculture and Rural Development of Colombia from 2013 to 2015, which was inspired by the work conducted in villages in Senegal (Howland et al., 2016). Colombian goals (formally known as "Nationally Determined Contributions" or NDCs) were agreed upon in the Paris Agreement in 2015, under the United Nations Framework Convention on Climate Change (UNFCCC), in which Colombia committed to create an MTA network with the participation of 15 departments, and one million of producers receiving agroclimatic information. As a result, through a sustainability process, trade unions such as FEDEARROZ and FENALCE undertook the leadership of MTAs with support from the National Meteorological Service (IDEAM, in Spanish), which leads MTA at the national level. As of 2017, MADR continued leading the MTAs initiative and, in partnership with FAO, the implementation of MTAs in Colombia.

The MTAs initiative launched a scaling-up process towards the Latin American region, starting in Honduras with seven MTAs established by the Secretariat for Agriculture and Livestock (SAG, in Spanish) in 2015. Then, in Guatemala, the first MTA in Chiquimula was created in 2018, and from that point onwards, a scaling-up process started with eight MTAs, with the help of the International Research Institute for Climate and Society from Columbia University, under the project "Adapting Agriculture to Climate Today, for Tomorrow" - ACToday[1], and other leading institutions.

The MTAs constitutes a dialogue process between a diversity of local stakeholders, including scientists, technicians, representatives of the public and private sector, and farmers, seeking to understand the possible behavior of climate in a location and generate recommendations to reduce the risks associated to the expected climate variability (Loboguerrero et al., 2018). As a result of such dialogue, an agroclimatic bulletin is generated, containing the climate prediction, its potential impact on crops for specific conditions in time and space, associated to recommendations for decision making for each production item. Climate predictions are generated in consensus with the meteorological service in each country and the existing agrometeorology groups from institutions, with the purpose of identifying the best practices to adapt to climate events, which are then transferred to technicians and local producers

[1] http://features.iri.columbia.edu/actoday-launches-climate-roundtables-in-guatemala

through the Local Agroclimatic Bulletin (Giraldo Mendez et al., 2018), and in some areas (Honduras, Nicaragua, Guatemala and Colombia) through the implementation of Participatory Integrated Climate Services for Agriculture – PICSA (Dorward et al., 2015)

The implementation of each MTA is specific to the context where it will be held. During 2019, an analysis process was carried out, with a focus on identifying transformations generated by MTAs in different countries. With this purpose, we have used the Outcome Harvesting approach, a methodology developed to assess programs and projects in complex contexts (Blundo-Canto et al., 2017). In this study, "outcome" is defined as an observable change in individuals, communities, organizations, or institutions that have modified their actions, agendas, relationships, policies, and practices of one or more stakeholders in the context where the program is being implemented. For this reason, to work under this approach, it is essential to have access to all the information and documentation needed to understand the changes produced.

In this document, we present the methodology and the results of the work performed, in four chapters. The first chapter presents the transformations generated by MTAs in Latin America, building upon the results of the Outcome Harvesting process. The second chapter contains an analysis of the implementation of MTAs in each context and focuses specifically in the different leadership and sustainability models. The third chapter presents the analysis of stakeholders for each country. The fourth chapter relates the producer families benefiting from the MTAS approach and at the end, it presents conclusions and recommendations.

It is worth mentioning that a first outcome harvesting process took place in 2016 to assess the transformations generated in 2014–2016 by MTAs established in Colombia, in Córdoba, Sucre, and Cauca (CCAFS, 2015) , which identified four areas of transformation.

Methodology

The starting point has been the analysis of 25 Local Technical Agroclimatic Committees (MTAs in Spanish) created between 2014 and 2018, as shown in the timeline in Figure 1. Analyzed MTAs are distributed in Colombia, Guatemala, Honduras, and Nicaragua.

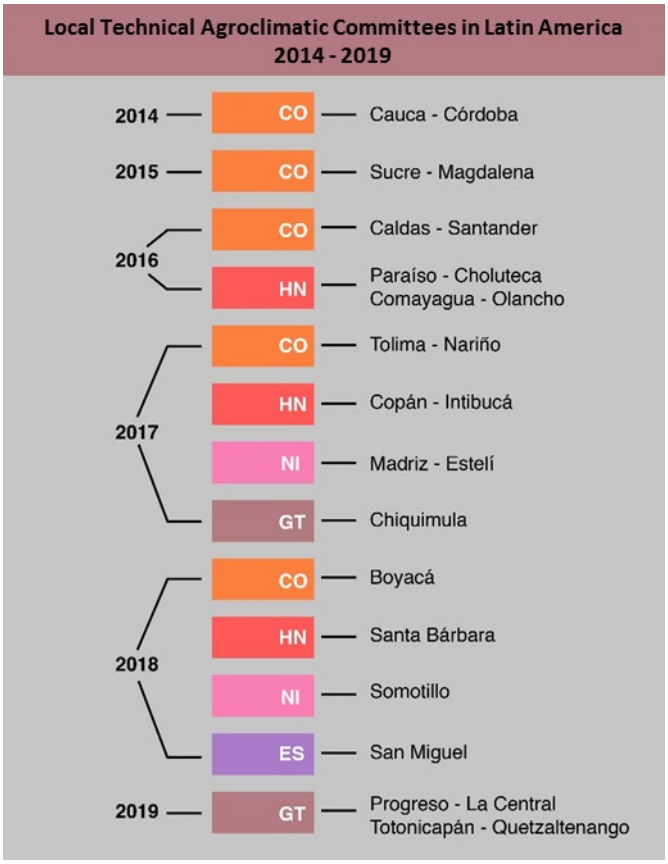


Figure 1. MTAS timeline (CO) - Colombia, (HN) - Honduras, (NI) - Nicaragua, and (GT) - Guatemala.

The methodological steps, developed using the Outcome Harvesting approach, include:

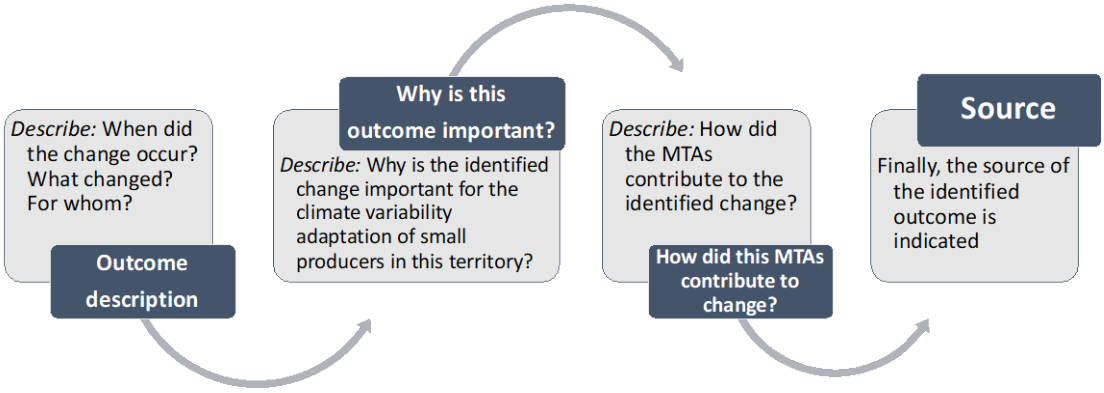
1. **Review of MTAs digital and printed material:** Detailed analysis of the situation of MTAs. From this first review a first map of stakeholders is developed. Deeper understanding of MTAS dynamics and a first round of outcomes is obtained.

2. **Interviews with focal points in each country:** Telephone interviews are carried out with focal points in each country to understand the history of the creation of MTAs in each context.

3. **First document:** A first document is drafted with the history of MTAs and the stakeholder maps by country.

4. **Field trip:** To enhance the Outcome Harvesting process, a field trip was organized to Guatemala (Chiquimula MTA), with one field visit, and in Guatemala City, we visited MTAs- participating institutions and organizations. In Honduras, we visited the Danlí, El Paraíso MTAs, and in Tegucigalpa, we visited MTAs-participating institutions and organizations. In Nicaragua, we visited the Somotillo MTA, and in Managua, we visited MTAs-participating institutions and organizations. In Colombia, we visited the Boyacá, Cauca, Córdoba, San Marcos, and Tolima MTAs, and in Bogotá, we visited the meteorologists. Finally, by other means, such as telephone calls or videoconferences, we interviewed key stakeholders.

5. **Outcome harvesting:** The outcome harvesting process is developed using the base instrument proposed by this approach.



For the Outcome Harvesting process, we have used documents, face-to-face and telephone interviews, web sites, chats review, and field visits. In a first round of outcome harvesting, 243 outcomes were obtained.

6. **Verification of outcomes:** The next step is analyzing the harvest to triangulate the outcomes obtained. This means that the statements identified must be confirmed in different ways: sources arriving to the same outcome, similar or duplicated. All outcomes must be verified. In case of doubt, they should be removed or sent to corroboration with stakeholders from the MTAs. At the end of this process, 145 outcomes were confirmed, and they are presented in this document (supplementary material).

7. **Identification of major transformation areas emerging:** Outcomes are grouped by major transformation areas. Generally, a graph may be built with all the outcomes identified.

However, in this case, due to the large number of outcomes, they are identified by colors. In this study, five major transformation areas were identified. This means that MTAs are generating transformations in five aspects that are very significant for the adaptation to climate variability of small and medium-sized producers in the territories where they are being implemented.

8. **Analysis of the major transformation areas:** Since the program under analysis, i.e., MTAs in Latin America, is so extensive and there were so many outcomes, a second grouping round was carried out within each of the five transformation areas.

9. **Building the theory of change:** The main result we expect to obtain from the Outcome Harvesting approach is to understand how MTAs are generating changes. Thus, the Theory of Change – ToC emerges out of the evidence collected in the field, where the contribution of MTAs becomes evident.

10. **Other related products:** In addition to the Outcome Harvesting process, we have generated an analysis of the differences in the way MTAs have been implemented, which, despite having in common a core methodology, is adjusted to each context. This comparison is the leadership analysis and its impacts on the MTAs sustainability, which is one of the major challenges.

A set of indicators has been developed for the emerging ToC, which will allow following up on the transformation areas identified. A stakeholder mapping was also carried out, identifying institutions and/or organizations taking active part in each MTA in Colombia. A comparative analysis was also conducted between the current ToC and the one identified in the 2016 Outcome Harvesting process in Colombia.

Chapter 1

Transformations generated by the Technical Agroclimatic Committees in Latin America

1. Transformations generated by MTAs in Latin America

From the evidence analyzed through the Outcome Harvesting process in Colombia, Honduras, Guatemala, and Nicaragua, five transformations emerge, which have been generated by the implementation of the MTAs. They have been identified as follows:

As previously described, these transformations emerge out of the evidence collected and validated based on the Outcome Harvesting process.

Transformation Area 1: Confidence in the quality of climate and agroclimatic information at the local Level

The confidence of institutions, organizations, and producer families in local climate information has been strengthened, leading to a better integration in decision making for agricultural processes.

This study shows that MTAs have encouraged a closer approach of national meteorological institutions to the needs in terms of local climate data. An important variation was detected in this sense, between the assessment conducted in 2016 and this one in 2020 since, for the former, there was less availability and capacity to undertake a local approach towards national meteorological institutions.

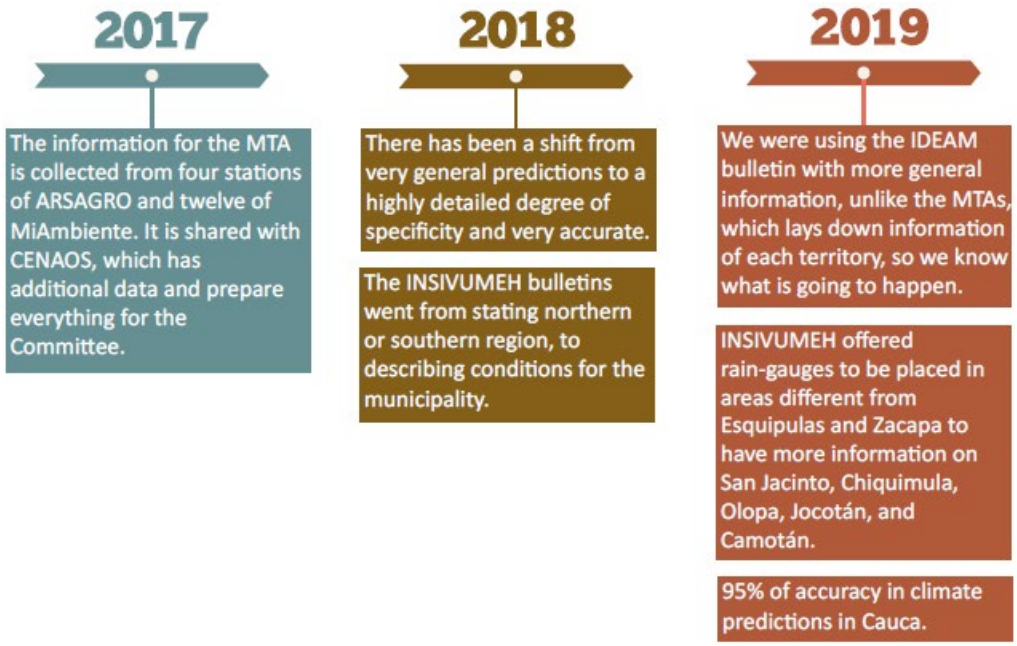


Figure 2. Transformation Area 1: Quality of climate information

Different strategies are evidenced, which have favored improving the quality of climate data in the territories and enhanced confidence on the part of local users of MTAs (Figure 2). There is evidence to identify the following:

a) The Guatemalan MTAs uses weather and climate information from the national meteorological institution and presents it at the MTAs meeting. This strategy is very important when there are no processed local data (for instance, quality control) to be mainstreamed into the MTAs. This is the case of INSIVUMEH, which has worked downscaling the analysis. *"We reduced the scale of the maps and showed the community the map of their interest."* Rosario Gómez, Head of the Research and Climate Services Department, INSIVUMEH, Guatemala. Here is also noteworthy the work carried out by CENAOS-COPECO in Honduras, which presents forecasts and predictions in each one of the seven MTAs operating in the country.

"We present the climate forecast and they (the MTA) meet to provide recommendations more specific to the variety of crops and prepare the agroclimatic bulletin they share with all regions. There are 90 weather stations across the country, but only 45 are operational; we use those in the National Electrical Power Company and the National Directorate for Water Resources. We use the data to be able to produce diagnostics by zone. The actual data are more dependable; satellite data are approximations to be adjusted to existing places. A general map is presented and compared with satellites, and then the historical data from previous years are used."

CENAOS-COPECO, **Honduras**

b) MTAs combines data from the national meteorological institution with information from meteorological networks, which are installed under the coordination of local entities and/or projects. This is the case of the Chiquimula MTA in Guatemala, where climate information from INSIVUMEH is combined with information from the local weather stations under the care of CUNORI, Anacafé, and Mancomunidad, as well as the information from the Central American Climate Outlook Forum (CA-COF), to be discussed in the quarterly meetings.

c) MTAs' leading institutions, such as FENALCE and FEDEARROZ have agroclimatic equipment at the disposal of MTAs in a territory, which they use to analyze the climate situation and the potential impacts on different productive sectors jointly with participants. They also compile information from national institutions and local initiatives. For instance, MTAs led by the rice sector in Colombia (Córdoba, San Marcos, and Tolima, among others) have been able to keep a meteorologist following up on the MTAs, where rice is one of the strongest production sectors.

"One of the achievements of the committee has been John Jairo; he is someone who has a great deal of knowledge and he also knows how to teach; he has gathered a work team, created a large network of stakeholders, and he is able to make people like attending the committees for the benefits they obtain."

Risk and Disaster Management Advisory
Office of the department of Cauca - **Colombia**

d) Some MTAs are not yet supported by national meteorological institutions; thus, they use data from local weather stations, which are taken by organizations, institutions, and projects being implemented in the territory. This is the case of Nicaragua, specifically in

Somotillo, where producer families receiving support from the SanSeco2 Project collect information from weather stations installed and analyzed by Heifer and present it at the MTAs.

e) There is a clear interest of national meteorological institutes on the efforts undertaken at the local level, based on the experiences with MTAs. The challenges faced are associated with available resources, capacity to install, maintain, and analyze local stations, as well as the quality of data from third-party stations.

> *"Rain-gauges and thermometers in farms depend on quality tests (the way readings are taken, adjustments, calibration). Data should be homogenized and the time in which readings are taken should be the same; it is necessary to establish mechanisms for information to be transferred to CENAOS."*
>
> CENAOS-COPECO, **Honduras**

Other factors contributing significantly to increase confidence in local climate data are the different local initiatives monitoring climate, which become specialized based on initiatives linked to MTAs, such as Chiquimula in Guatemala or San Marcos in Colombia.

> *"The committee has brought about the existence of a Forecast Regional Center (CRP, its initials in Spanish) in Corpomojana, which is providing us with data on the territory twice a week. Can you believe this? With the CRP I can decide that tomorrow I am going to spray before noon. With the MTA I decide the date for sowing, herbicide control, and fertilization."*
>
> Rice producer and owner of a small rice mill, San Marcos - **Colombia**

MTAs have contributed a lot in understanding the climate information and forecasts as a probability with a degree of uncertainty. This increased knowledge on the type of information has also contributed to its credibility. *"My first move was to provide training to crack the paradigm of certainty."* Alex Rojas, Meteorologist at FEDEARROZ, Colombia.

In addition to the availability of more and better local information, other factor contributing to local confidence is that MTAs have achieved a simpler and more educational way of communicating climate information, which has improved their understanding. Thus, it is not some distant or abstract knowledge for producer families and entities in the territory. *"If there were no MTAs, we, climate engineers, would not be able to go beyond technical matters."* Director of INSIVUMEH, Guatemala.

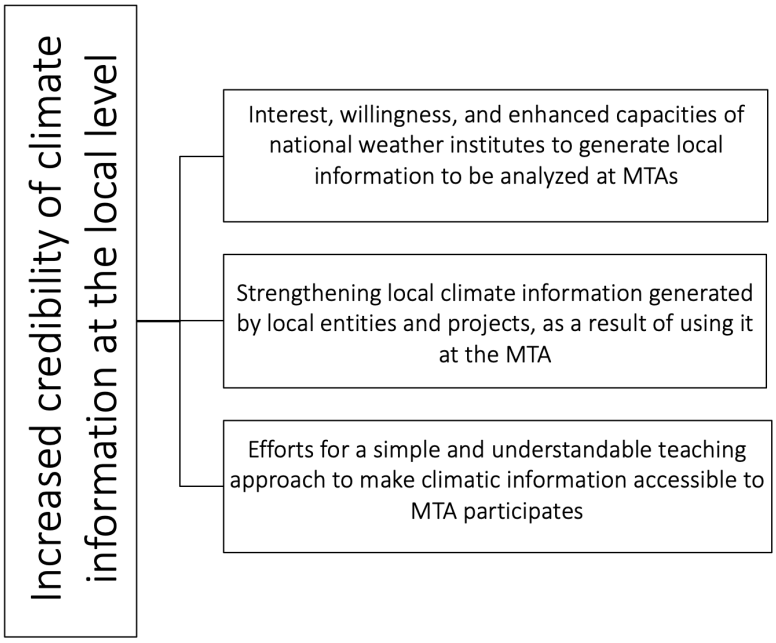


Figure 3. Outcome 1: Transformation of the quality of climate information.

Considering the evidence of changes generated by MTAs in Latin America, we identified a first transformation area that we have called: Enhanced credibility of climate information at the local level, as shown in Figure 3.

Transformation Area 2: Knowledge, understanding, and connection of agroclimatic information

Agroclimatic information and strategies to adapt to the impacts of climate variability and change have become known, understandable, and accessible for institutions, organizations, and producer families in the territories.

Other transformation arising from the Outcome Harvest is related to the access to agroclimatic information in local spaces. This means, the evidence collected shows that agroclimatic information:

- **Is more widespread**, i.e., it reaches people beyond MTAs, because several mechanisms have been set up to make it useful and actionable in the territories.

- **Is more understandable**, as efforts have been undertaken for MTAs activities to have a better understanding of scientific information on climate, as well as the different formats used for the dissemination of the information generated by MTAs.
- **Is more connected** with the needs of territories. The methodological step of MTAs to make recommendations collectively, compiling the different knowledge of participants encourages the co-generation of knowledge in a concrete reality (agricultural production practices). The interface between information providers and users of the agricultural sector has facilitated the dissemination of the agroclimatic information and the recommendations for adaptation.

The evidence shows that agroclimatic information communication processes have been modified and strengthened with the purpose of adapting to the needs and understanding in the territories (Figure 4), where there is a clear outreach effort on the part of meteorologists taking part in the MTAs.

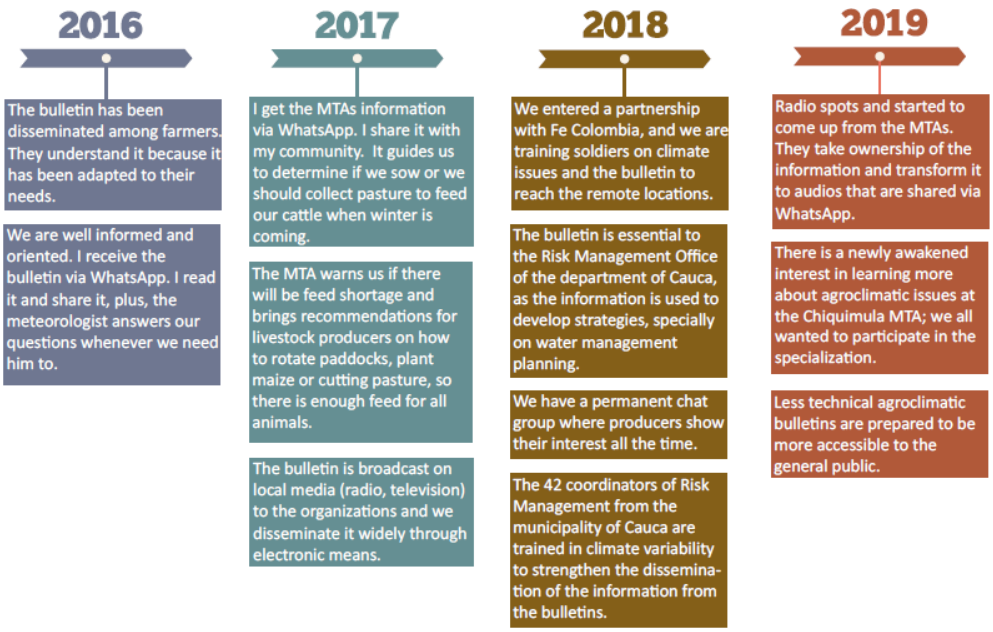


Figure 4. Transformation Area 2: Communicating the agroclimatic information.

Whether they belong to public institutions in charge of meteorology (as in the case of Honduras (CENAOS-COPECO), Guatemala (INSIVUMEH), or Colombia (IDEAM)), or they are professionals hired by trade unions, projects, or institutions (as in the case of FEDEARROZ professionals), or they belong to local entities in academia or research centers (as in the case of CUNORI), MTAs have led to a very important effort to improve the access to understanding a scientific knowledge that has remained distant from the end user of this information.

"As a university professor, I use my knowledge to communicate small and medium-sized producers the information that was not reaching them in the past. I have had to create a simple and understandable teaching approach to make climate information accessible to the people who come and take part in the MTA, so it may be understood by everyone." Professor Arturo Asencio, IDEAM in the Boyacá MTA - **Colombia**

One way of making information available to MTAs participants, whether they are producer families, institutions, organizations, or projects, is the methodological step involving the preparation of recommendations by production sector. In terms of the ownership and communication processes of agroclimatic information, this step is highly important, as it enables a shift from scientific information to concrete reality, based on production practices. It is important to mention that such important methodological step is not being implemented in all MTA. One of the reasons for this is the lack of available time, because it is not prioritized in the agenda, or because the committee is more focused on a certain group.

"Personally, it has been very helpful, because when someone used to talk to me about a station, I imagined something very large. One day at the MTA, they told me let's visit the stations. I could not believe how important is something so small, generating such relevant information. At the MTA one realizes the importance of this."

Technician, ARSAGRO - **Honduras**.

Other transformation arising from the evidence is the wide variety of strategies being used in countries with MTAs to disseminate the information. Usually, we follow the methodology established to draft a bulletin containing local agroclimatic information, climate predictions, and recommendations by production sector. This is the basis to generate by-products of the bulletin, as well as an important diversity of means to distribute the information prepared, which may be divided in face-to-face, traditional, and digital media.

a. Dissemination media:

Printed media: Several MTAs still print the bulletin, especially for populations without access to mobile phone connections (ARSAGRO, El Paraíso, Honduras), when it needs to be used in workshops (Asofagan, San Marcos, Colombia), or when it is distributed among promoters and

technicians in the communities (SanSeco2 in Nicaragua). However, printing the bulletin is not a widespread practice, on the contrary, this strategy is in decline.

By-product: The formats of the original bulletin are diversified, e.g., preparing summarized versions, like the Climate Change Unit at the Secretariat for Agriculture (SAG) in Honduras, which drafts a 4-page leaflet for producer families, which is posted on boards at SAG regional offices. Other example of by-products is seen in Cauca, where half-page bulletins are prepared only with recommendations by production sector to be read in collective spaces, such as churches and civil associations, among others. These are distributed by promoters from the Secretariat for Agriculture in the communities where crops are produced in the Department of Cauca.

Compilation: Other distribution methods include the integration of information into other pieces that were already distributed previously or have an allocated budget. For instance, the risk management posters of the department of Cauca include a summary of the Local Technical Agroclimatic Committee's (MTAs in Spanish) bulletin.

b. Dissemination by traditional media:

By word of mouth: This is one of the most common media to disseminate the MTAs results. It is an extremely important means and we cannot talk about MTAs communication without considering it with the relevance it deserves. The family attending the MTAs communicates by word of mouth with the family that could not participate. Also, the communication between the technician from a local organization or a public institution (SAG, MARN, MIambiente, FEDEARROZ, and ARSAGRO, among many others) with producer families in workshops and producer associations' meetings often organized with the purpose of sharing the MTAs information, as is the case of Asofagan in San Marcos, **Colombia**.

> *"The bulletin generated by the MTA involves a very solid diffusion process; it is first sent to the Secretariats for Agriculture in the municipalities. The other diffusion method is through commercial broadcasters, such as* Cauca Noticias *noon newscast, involving 15 community radio stations, as well as* Radio Súper*, the UMATA's radio station. We put an emphasis on our contact with people on the field, which has allowed us to identify the relevant community radio stations and open up spaces for us to disseminate the bulletin. Those making the*

*presentations on the radio were people from the area, and at the end we started choosing students from educational institutions.***"**

Juan Diego Otero, Soil Department of the Secretariat for Agriculture and Rural Development, Cauca - **Colombia**

This is also the way to proceed with the Fe Colombia Plan, where training was provided to the army on agroclimatic information, so they could share the information in the bulletin by word of mouth in the communities of Cauca where they are based. This was also done with churches in Valle del Cauca to be shared along with the parish announcements.

Radio and Television: Other means frequently used are radio and television, mainly local and community stations, in shows for farming families or shows produced by the municipalities. It has been possible to develop important partnerships in some MTAs territories to use these massive media, although this has not been done as much as it would be possible.

"*The bulletin is broadcast in 15 community radios, UMATA radio stations, commercial broadcasters* (Cauca Radio*,* Fe Colombia*, and* Radio Súper)*, local television, local newspapers, social media, the Secretariats for Agriculture, risk management coordinators, churches, and the army in Cauca.***"**

Juan Diego Otero, Soil Department of the Secretariat for Agriculture and Rural Development, Cauca - **Colombia**

c. Dissemination on digital media:

Communities of practice in WhatsApp: The evidence shows that digital media, specially chats, and WhatsApp, are the communications and dissemination strategy for bulletins and all the agroclimatic information generated by the MTAs. All MTAs have created a WhatsApp group where they share the bulletin, which is in turn disseminated by the same channel to other individual chats or digital accounts. The message chain is infinite; by this means, the agroclimatic information is spread virally. **"***I distribute the bulletin through WhatsApp to at least 50 contacts, which redistribute it to at least 20 contacts, and so on.***"** *FENALCE, Tolima -* ***Colombia***

At the same time, WhatsApp is used not only to disseminate the bulletin, but also production practices implemented and their results, technical recommendations, mutual support in case of doubt, or complex situations with pests or other matters in the field, early warnings,

information on new products, and courses or workshops of interest related to the subject of MTAs (Figure 5). It is safe to say that with the evidence generated by MTAs, rather than disseminating information with digital means, they have created local communities of practice on agroclimatic issues, with the engagement of different stakeholders from the agricultural sector using electronic media. Moreover, these communities of practice remain, even if the MTAs stop meeting when budgets are used up, as it has been the case of some MTAs analyzed.

"We have a WhatsApp group that works for advice and technical assistance. If the producer notices a pest or disease, he (she) uploads it to WhatsApp and everyone starts assisting him (her)."

Development Cooperative Federation (FECODESA) technical team, Somotillo - **Nicaragua**

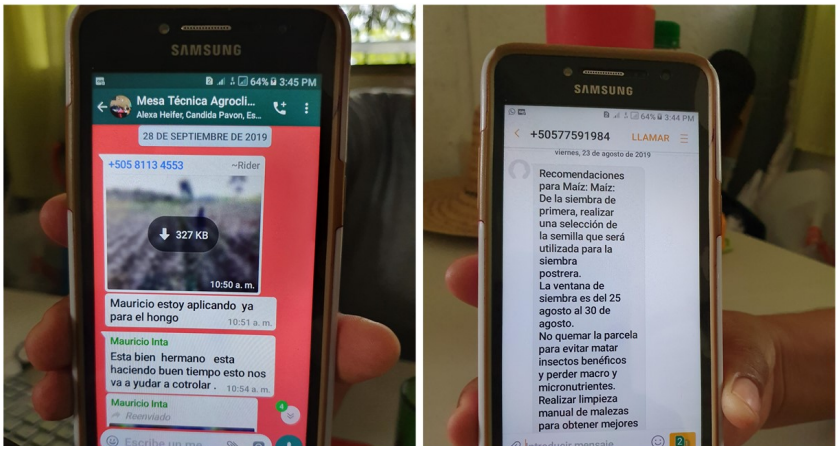


Figure 5. WhatsApp conversations and bulletin in Somotillo

For the communities of practice in WhatsApp, different formats and wording are used. Videos and audios are very frequently used, in addition to text.

"Audios or spots from the MTAS started to come up, they take ownership of the information and transform it into audios that are shared via WhatsApp."

Rosario Gómez, Head of the Research and Climate Services Department, INSIVUMEH, **Guatemala**.

For this transformation, we recommend systematizing the communities of practice, mainstreaming digital media into the methodological step for the dissemination of the

bulletin, as well las making some recommendations and trainings on the safe use of technology.

> *"The WhatsApp group is very active; there are technical discussions of climate, agriculture, problems arising from climate change and variability, technical advances, field days, etc. Many other things beyond the LTCAs are shared among entities and individuals participating."*
>
> Alejandro Arames, FENALCE, Córdoba - **Colombia**

Text messages: Although this is a very effective means, especially for rural populations without internet connection, there is little evidence of its use (it is mentioned only once in Somotillo). This is probably due to the cost that it might represent for the person sending and receiving the text.

Websites and social networks: Unlike digital chats, there is little update of websites with agroclimatic bulletins and MTAs information. Furthermore, there is little evidence of the use of social networks to disseminate the results of MTAs. Even though a comprehensive analysis was carried out, little evidence was found on the use of these means.

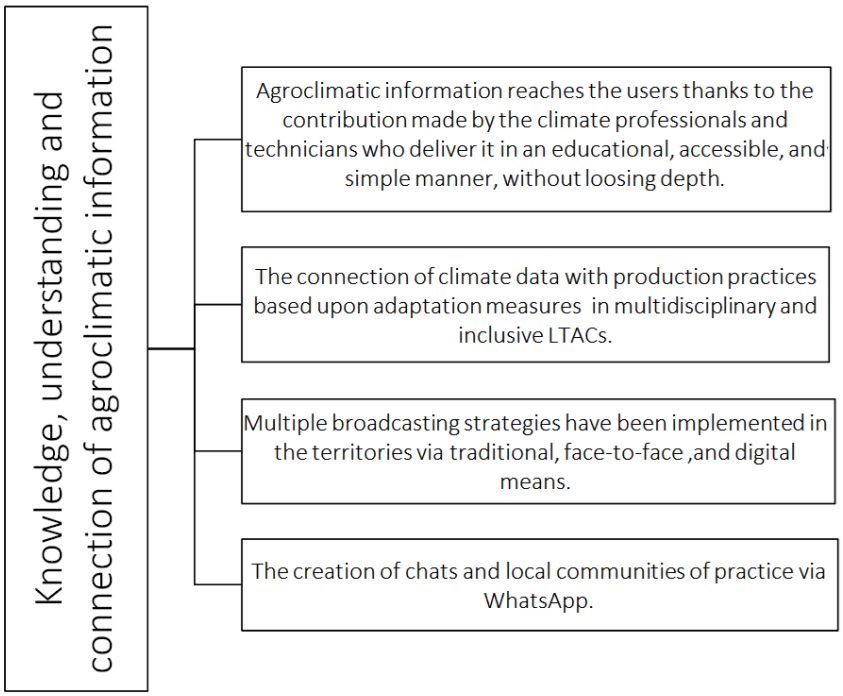


Figure 6. Outcome 2: Communicating the agroclimatic information.

The second major transformation area generated by the Outcome Harvesting process was **the communication of agroclimatic information at the local level,** at the Local Technical Agroclimatic Committees (MTAs in Spanish) (Figure 6). It should be noted that this is a very important outcome. According to the survey undertaken for this analysis, the information generated by the MTAs reaches 80% of end users through the network of organizations, institutions, entities, and individuals participating in the MTAs. As mentioned above, these are replicated in a viral process. But it is also clear that a lot more population working in the agricultural sector needs to be covered in the territories where the MTAs are located.

> *"As someone who lives here, I had never heard of the committee and I had no idea what an MTA was. I started to find out, once I was already sitting there. My family, a farming family, had never received any information on climate issues. At the governorship, very few people know about the MTAs."*
>
> Claudia Menéndez, INSIVUMEH, Chiquimula - **Guatemala**

Transformation Area 3: Democratization of climate knowledge

We have set up a space to facilitate scientific literacy[2] thus democratizing agroclimatic knowledge.

While this outcome is indeed limited to the population taking part in the MTAs, the Outcome Harvesting process shows that there is a very important transformation in terms of democratization of agroclimatic knowledge with "the creation of a scientific collective awareness that would necessarily strengthen the democratic society (...) scientists are also morally responsible for devoting part of their work and time to liaising with the public."[3]

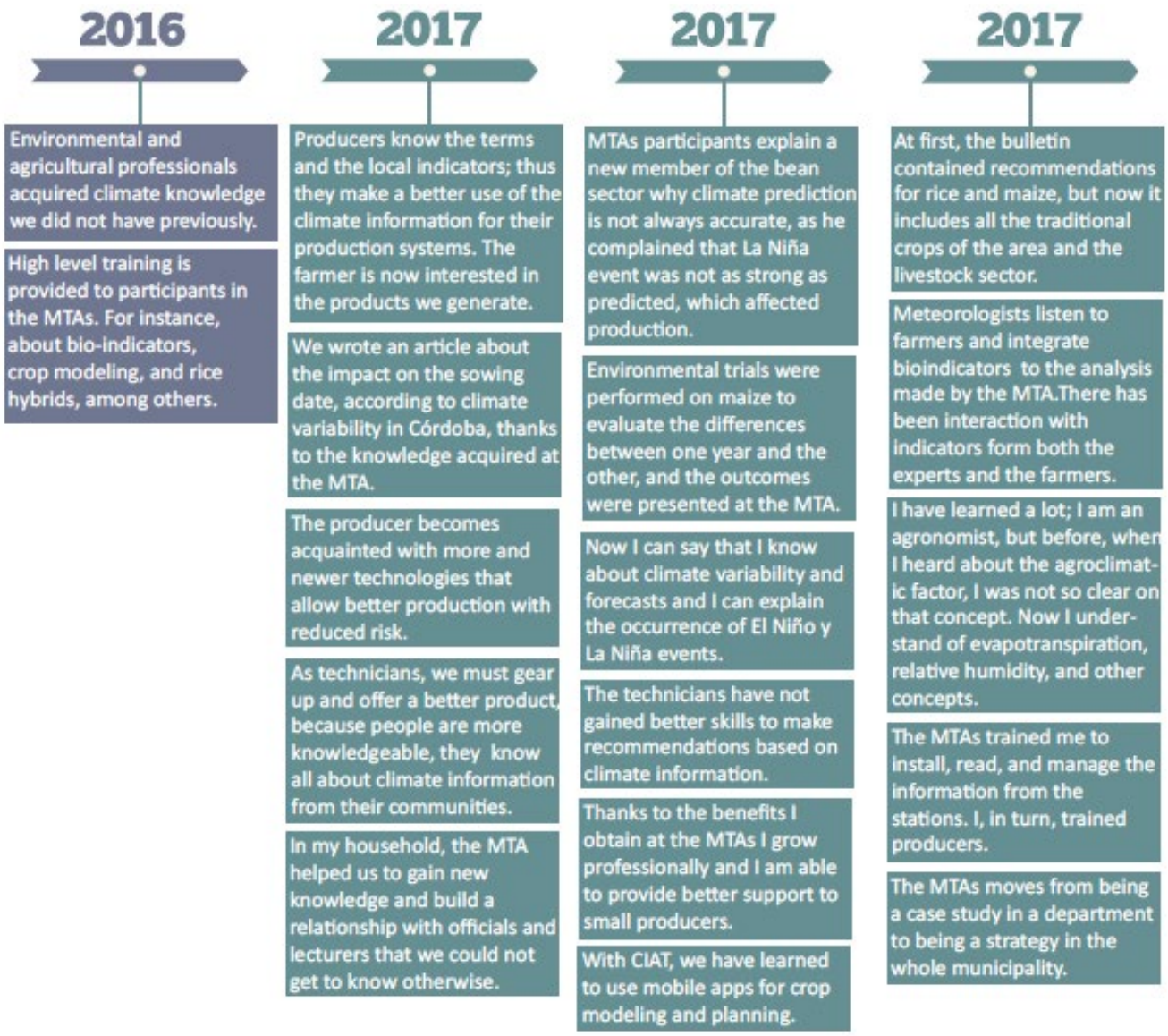
[2] Currently, the use of "scientific literacy", "public knowledge or understanding of science" or "scientific culture" is preferred. In any case, the main idea is bringing science closer to the general public to meet the social requirement of scientific information. Thus, the presence of scientists, professors, journalists, and writers who can help society overcome its fears on science is crucial to this process.

[3] Calvo, Manuel. (2002). ¿Popularización de la ciencia o alfabetización científica? *Ciencias* 66, abril-junio, 100-105. [Online]

Four outcomes arise from this transformation area relating to democratization of knowledge (Figure 7):

a) Producer families take ownership of agroclimatic knowledge: Producer families participating in the MTAs, or replicates held by organizations and institutions, demonstrate having an agroclimatic knowledge they previously lacked. There is evidence of new terms and, of an understanding of the relationship between climate variability and its effects on crops, seeds, pests, floods, and droughts, among many others.

> *"Producers know the terms and the local indicators; thus, they make a better use of the climate information for their production systems. The farmer is now interested in the products we generate."*
>
> CENAOS-COPECO, **Honduras**


2016
Environmental and agricultural professionals acquired climate knowledge we did not have previously.
High level training is provided to participants in the MTAs. For instance, about bio-indicators, crop modeling, and rice hybrids, among others.
2017
Producers know the terms and the local indicators; thus they make a better use of the climate information for their production systems. The farmer is now interested in the products we generate.
We wrote an article about the impact on the sowing date, according to climate variability in Córdoba, thanks to the knowledge acquired at the MTA.
The producer becomes acquainted with more and newer technologies that allow better production with reduced risk.
As technicians, we must gear up and offer a better product, because people are more knowledgeable, they know all about climate information from their communities.
In my household, the MTA helped us to gain new knowledge and build a relationship with officials and lecturers that we could not get to know otherwise.
2017
MTAs participants explain a new member of the bean sector why climate prediction is not always accurate, as he complained that La Niña event was not as strong as predicted, which affected production.
Environmental trials were performed on maize to evaluate the differences between one year and the other, and the outcomes were presented at the MTA.
Now I can say that I know about climate variability and forecasts and I can explain the occurrence of El Niño y La Niña events.
The technicians have not gained better skills to make recommendations based on climate information.
Thanks to the benefits I obtain at the MTAs I grow professionally and I am able to provide better support to small producers.
With CIAT, we have learned to use mobile apps for crop modeling and planning.
2017
At first, the bulletin contained recommendations for rice and maize, but now it includes all the traditional crops of the area and the livestock sector.
Meteorologists listen to farmers and integrate bioindicators to the analysis made by the MTA.There has been interaction with indicators form both the experts and the farmers.
I have learned a lot; I am an agronomist, but before, when I heard about the agroclimatic factor, I was not so clear on that concept. Now I understand of evapotranspiration, relative humidity, and other concepts.
The MTAs trained me to install, read, and manage the information from the stations. I, in turn, trained producers.
The MTAs moves from being a case study in a department to being a strategy in the whole municipality.

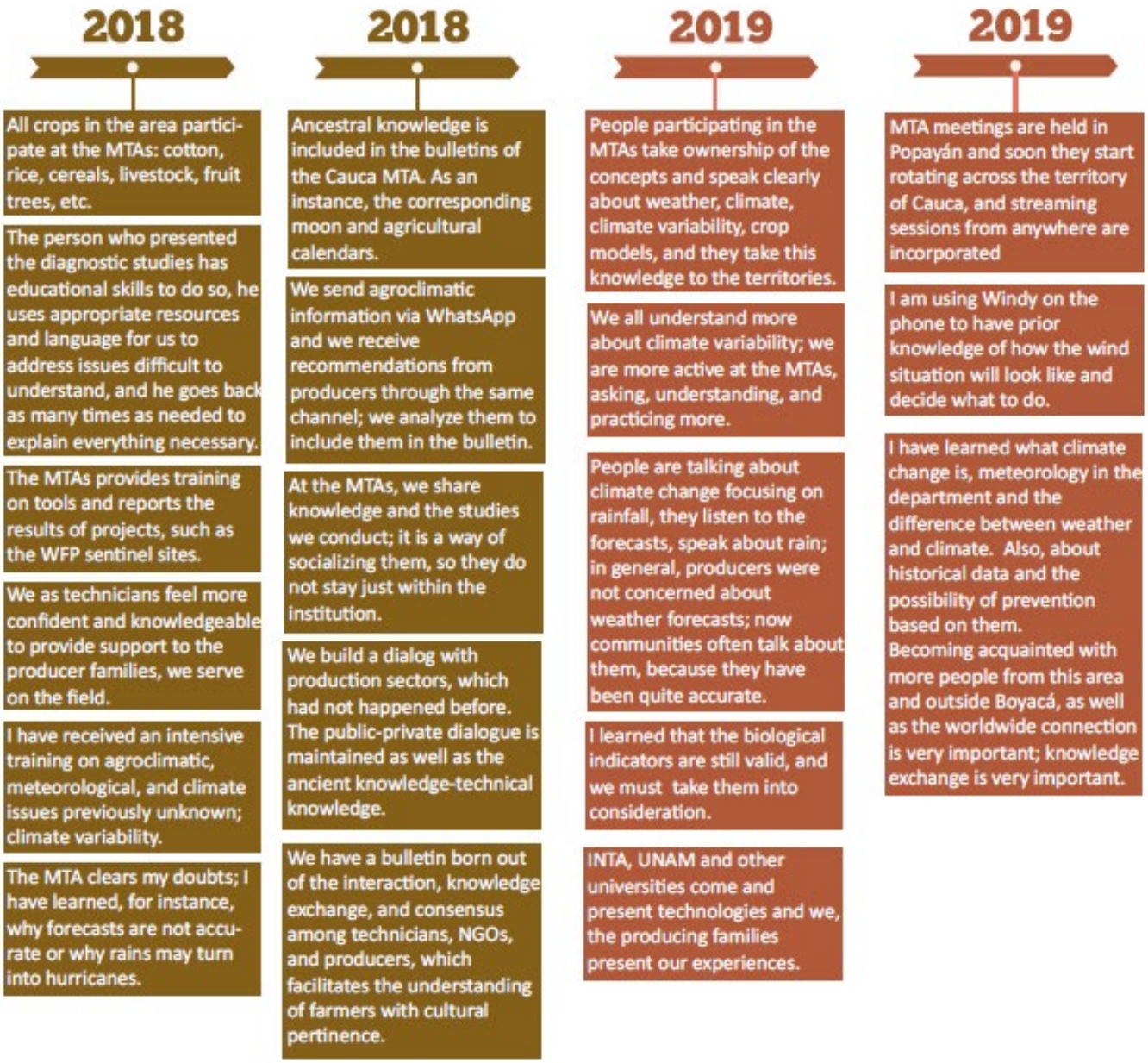


Figure 7. Transformation Area 3: Democratization of knowledge

It is important to mention that much of this is reinforced with MTAs partner projects that follow up on the production practices and use the information generated by the MTAs. This is the case of FEEARROZ, PICSA, *Un Viaje Común*, CSVs, SanSeco2, AgroCauca, and Boyacá Agro, among many others. The Outcome Harvesting process shows that MTAs have undoubtedly allowed participating producer families to gain knowledge on climate, climate variability, climate risk, El Niño and La Niña events, winds, rainfall, climate change, and drought, which are the concepts most frequently mentioned by them in this analysis.

> *"I am already acquainted with principles such as warming of the Pacific Ocean, cooling, or La Niña event, and when I see the colors in the maps, I know La Niña is coming, and I am able to guide others."*
>
> Producer, San Marcos - **Colombia**

b) Technicians mainstream agroclimatic knowledge into their profile: Other groups showing a transformation in knowledge are promoters, field technicians, and those responsible for technical assistance. Technicians working in national and international organizations, associations, trade unions, or the public and private sector, concentrate the largest amount of evidence on mainstreaming new knowledge into a local group. It has become apparent that this has two important effects: it creates certainty in technicians about the relationship between climate variability and impacts on the production sector and it strengthens the attention to producer families.

> *"I have learned a lot; I am an agronomist, but before, when I heard about the agroclimatic factor, I was not so clear on that concept. Now I understand about evapotranspiration, relative humidity, and other concepts. In the organization, farmers feel an increased support, thus, when the production cycle nears, they ask when it is going to rain, and what variety can I recommend. They want to know very specific things, such as when should they apply a fertilizer, fungicide, etc. I can answer them with more certainty, thanks to what I have learned at the MTAs, which prevents them from feeling abandoned."*
>
> Technician, ARSAGRO – **Honduras**.

There is evidence of three important effects: There is a more informed demand from producer families.

> *"As technicians, we have to be prepared and offer a better product, because people are more knowledgeable; they know all climate information from their communities."*
>
> CENAOS-COPECO, **Honduras**

Technicians become confident, because they strengthen their knowledge on the impact of climate variability on production sectors.

> *"Now I can say that I know about climate variability and prediction, and I am able to explain the occurrence of El Niño and La Niña events. Thanks to the benefits I obtain at the MTAs, I grow professionally, and I am able to provide better support to small producers."*
>
> Sec. for Dev. and the Environment, Mayor's Office, San Marcos - **Colombia**

The capacity for attention to producer families is strengthened.

> *"We technicians have developed better skills to make recommendations based on climate information."*
>
> Technical Assistants in maize, cotton, fruit trees, vegetables and rice, Montería - **Colombia**

c) The MTAs becomes a space for cross-sectional knowledge and networking: There are many outcomes harvested describing the inclusive space generated at MTAs, especially when carrying out the methodological step of making recommendations collectively. Noteworthy are the respect and inclusion of farmer and ancestral knowledge by meteorologists, as well as in the recommendations and climate predictions sent in the bulletin. Some bulletins have a section for bioindicators, the movement of the moon in relation to climate, and other outstanding local knowledge, as is the case of Cauca.

> *"Meteorologists listen to farmers and include bioindicators in the analyses conducted by the committee. We have interacted with indicators of both experts and farmers."*
>
> Rice producer, San Marcos - **Colombia**

Also, in Cauca, climate predictions are sent to producer families and they are asked to send recommendations, which they do using WhatsApp; these are validated to generate recommendations for the adaptation of different crops, which will be included in the bulletin and other information products.

> *"INTA, UNAM, and other universities make presentations of technologies and we, the producer families, present our experience."*
>
> Development Cooperative Federation (FECODESA) technical team, Somotillo – **Nicaragua**

The MTAs has also become a meeting space for networking, where collective plans are developed beyond the MTAs agenda. Participants show that this is one of the unexpected and intangible effects generated by the MTAs. This is a meeting place for stakeholders who are working in the same sector but are not able to meet frequently. In addition, this is a space where it is possible to

meet with people from other places and exchange knowledge and experiences with them. The MTAs as a space to build networks and partnerships is another outcome identified in this study.

> *"We have a bulletin born out of the interaction, knowledge exchange, and consensus among technicians, NGOs, and producers, which facilitates the understanding of farmers with cultural pertinence."*
>
> Martín Leal, Coordinator of the Climate Change Unit at MAGA, **Guatemala**

d) The MTAs is a local space for capacity building in areas related to agriculture and climate: MTAs are used as spaces for training. As pointed out at CUNORI "*the MTA is like a climate school."* This space is used to provide training in new tools, to present the results of experiments on the field (such as sentinel plots), to submit or develop projects (such as Boyacá Agro). Furthermore, a request by the MTAs prompted a need for a certificate course in Participatory Integrated Climate Services for Agriculture - PICSA (Dorward et al., 2015) in Guatemala, in which several participants are trained.

> *"I am using* Windy *on the phone to have prior knowledge of how the wind situation will look like and decide what to do. I learned this in an MTA training."*
>
> Farmer and member of the board of FENALCE,
>
> San Marcos, FENALCE, Córdoba, and FAO, Córdoba - **Colombia**

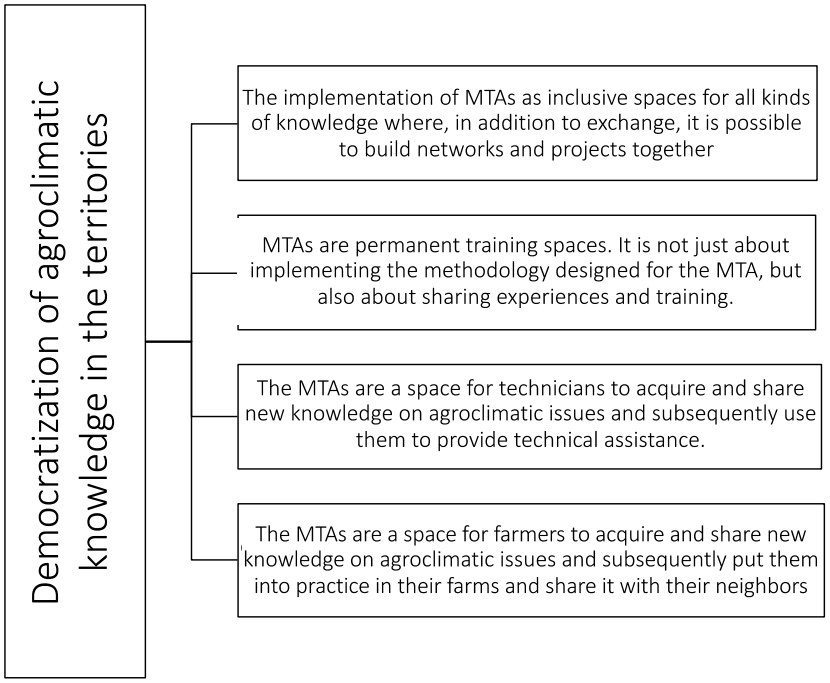


Figure 8. Outcome 3: Democratization of climate knowledge

The third major transformation area generated by the Outcome Harvesting process is the effect of the MTAs as a space for the democratization of agroclimatic knowledge involving multiple stakeholders that take part in the MTAs (Figure 8).

Transformation Area 4: Transformation of production practices

Producer families adapt their practices making decisions based on the information they receive about climate variability in their territory, which leads to reduced losses and in some cases, an increased profitability per hectare.

In the assessment of 2016, very little evidence was found on the transformation of production practices in the territories where MTAs were held. In this study, in 2019, we were able to confirm that changes in production practices started being implemented in 2017 in farms and plots belonging to producer families, based on the recommendations generated by the MTAs, which were disseminated through different means, as mentioned above.

2017

I had an increase of one tone per hectare in my production and an increased profitability by changing the sowing date and reducing the use of insecticides, fertilizers, and pesticides.

Three producers who change their sowing date produce 3 tons more and have a demonstration effect over the others, who change their sowing dates the next year, according to the recommendation of the MTA.

At the company, we changed the time to start plant nurseries. It used to be on January, now we do it on February or March, depending on what the MTA recommends.

We used new rice varieties, such as Feearroz2000, which adapt to the climate in the area and we have learned to sow it during the best moths.

2017

In my field, I have performed caballoneo (efficient water management technique) to retain rainwater, thus my field will retain more moisture and avoid runoff. I have an improvement of 500 kilos per hectare, which are about 8 to 10 bundles. It is noticeable!

ARSAGRO producers know about agroclimate issues and look forward to the MTA bulletin we distribute to make decisions about sowing. The MTA has allowed solving many problems and the producers feel supported.

My production has improved an 80%. My profitability has increased since I modified the way I used to sow. Now, I sow the lower land, as it floods earlier, and then the higher land.

2018

Rice, watermelon and maize producers sow at different dates, because they wait for the forecast of the MTA to decide the date.

In San Marcos, they used to sow without prevention in April-May; this has changed to the point in which sowing is performed in June since environmental supply is better. Before the MTA, this was not known.

There has been a change in the mentality of producers; now they consult about climate variability and recommendations for their crops, and they base their decisions on information from the MTAs

We know how to consult the level of rivers to make decisions with early warnings.

Sowing dates for rice and maize were proposed, and those producer families who complied (20 to 30% of all the families) were much less affected by loss.

2018

Half the producer families associated to Asociasión de Productores(as) de Oriente have changed some practices under the recommendation of the Danli MTA.

I use the MTA forecasts for the community rain water harvesting project. We have two 450,000-L reservoirs, which are below the mid-point and we are waiting for the forecasts to make decisions, because the season is supposed to end in October and that is not enough for the dry season.

At the community level, vegetable production has been modified using MTAs forecasts. We know we are not getting a rainy season as they were before, so we have to sow more, because cycles are shorter. This means changing our whole culture to be able to respond to climate.

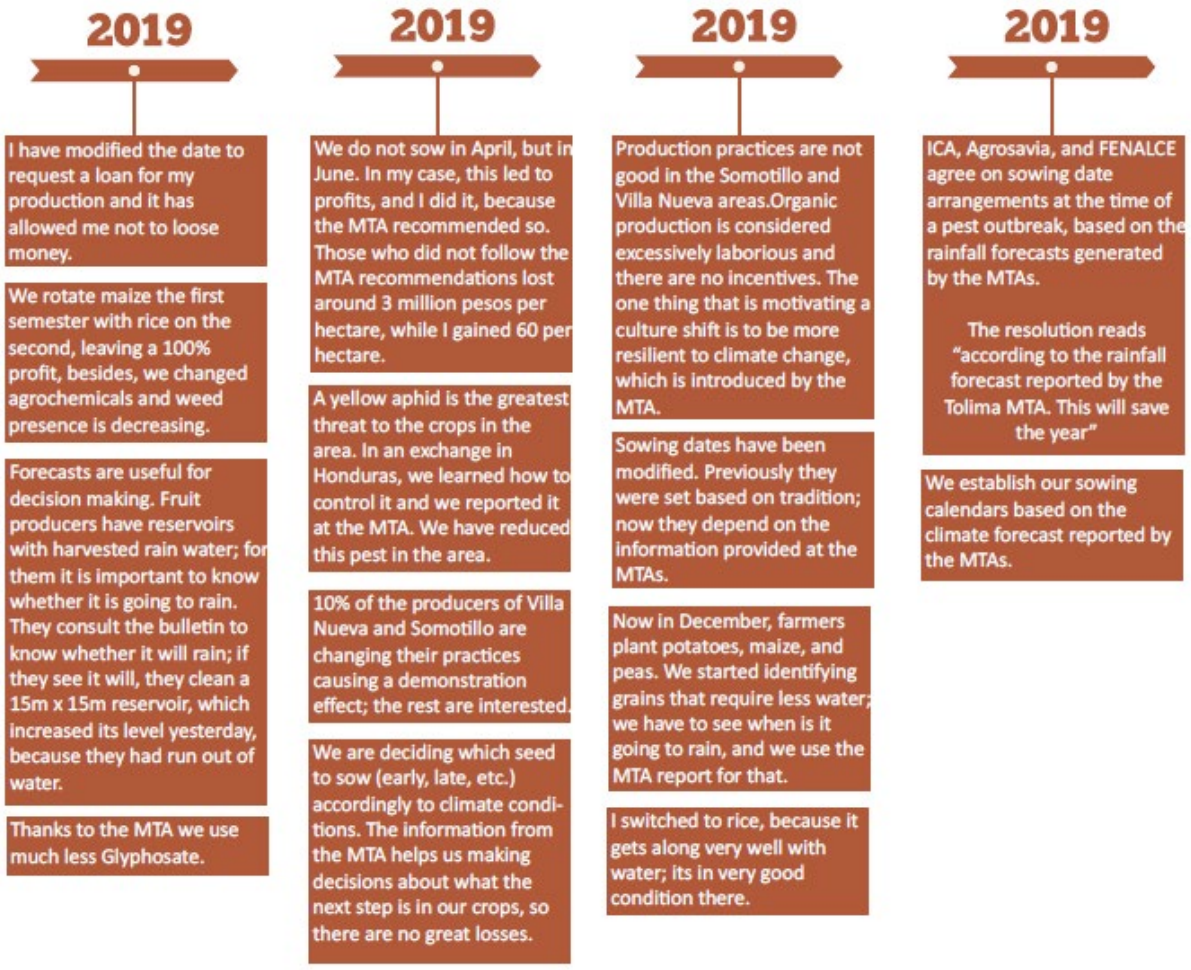


Figure 9. Transformation Area 4: Change in production practices

There is also evidence of organizations and institutions participating or being somehow related to the MTAs that use the information generated there (predictions, forecasts, and recommendations for adaptation) to be mainstreamed into programs and projects transforming production practices, which relate to risk management, food security and sovereignty, among others.

The evidence highlights a series of production practices that families and institutions modify based on the agroclimatic information they received at the MTAs Figure 9. Transformations have been detected in:

→ Changing the date to request credits to adjust it to the new sowing date.
→ Changing the sowing date; it is not always the same, it depends on the recommendations of the MTAs.

"Sowing dates have been modified. Previously they were set based on tradition; now they depend on the information provided at the MTA."

Technical Assistant in maize, cotton, fruit trees, and vegetables, Montería – **Colombia**

"We do not sow in April, but in June. In my case, this led to profits, and I did it, because the MTAS recommended so. Those who did not follow the MTA recommendations lost around 3 million pesos per hectare, while I gained 60 per hectare."

Producer, San Marcos - **Colombia**

→ Preparation of tanks for rainwater harvesting, depending on rainfall forecasts.

"Forecasts are useful for decision making. Fruit producers have reservoirs with harvested rainwater; for them it is important to know whether it is going to rain. They consult the bulletin to know whether it will rain; if they see it will, they clean a 15 m x 15 m reservoir, which increased its level yesterday, because they had run out of water. In my municipality, I use the MTA forecasts for the community rainwater harvesting project. We have two 450,000-L reservoirs, which are below the mid-point and we are waiting for the forecasts to make decisions, because the season is supposed to end in October and that is not enough for the dry season."

Coordinator of the Environmental Management Unit in the municipality of Chiquimula - **Guatemala**

→ Pest prevention according to climate variability, including time to apply fungicides and the use of alternative treatments learned at the MTAs.
→ Return to ancestral practices (rake, organic waste, and land rotation, among others).
→ Crop rotation, for example, in high/lowlands, combination of two products or diversification of plots, depending on the recommendations of the MTAs.

"Now in December, farmers plant potatoes, maize, and peas. We started identifying grains that require less water; we have to see when it is going to rain, and we use the MTA forecast report for that."

PICSA promoter and farmer, Boyacá – **Colombia**

→ Change of seed varieties based on some of the experiments presented at the MTAs, which are promoted by projects and organizations.

> *"For instance, I have sown in June-July, instead of April. The date for sowing has changed because of climate. I have also changed my sowing system; previously I sowed more than now; I have changed my methods and theory about sowing. The use of insecticides has changed; the volume of pesticides, fertilizers, and insecticides has been reduced. All this helped me obtaining an increase of one tone per hectare and in my profitability. Nearly everyone has made changes: those who have not attended the committee hear to the story from someone else and follow the lead. I started making changes four years ago."*
>
> Melciades Alejandro Machado Fernández, rice producer, San Marcos, **Colombia**.

In the process of transforming production practices, the effect of demonstrations plays a very important role. The producer families attending the MTAs or that are members of a participating organization play an important role, because they are often the ones that start making changes in the communities, which shows the importance of adapting practices to climate variability, and depending on their success and lessons learned, they are followed by the rest of families. Evidence of losses has also been found, because forecasts have not been accurate, especially at the beginning of MTAs. But there is an increasing understanding of the uncertainty in climate predictions.

It is very important to mention that the transformation of production practices is not widespread in the territories where MTAs are held. According to our research, it is estimated that 40% of producer families receiving the MTAs information attempt to transform their practices. They usually receive support from projects and organizations that also take part in the MTAs. The production units that transform their practices generate a demonstration effect replicated by neighbor families and friends.

The Outcome Harvesting process shows that transformations in production practices to reduce climate risk, based on the recommendations for adaptation, prevention, and mitigation of the effects of climate variability, are evident since 2017. This is a result of using the information generated at the MTAs, either individually or through programs and projects of participating organizations, institutions, and associations.

Transformation Area 5: Political advocacy and institutional transformation.

An interinstitutional partnership has been developed in the territories, which facilitates the adaptation of producer families to the risk posed by climate variability, through the creation and strengthening of programs, projects, and actions at the national and local level.

Most of the evidence found through the Outcome Harvesting process refers to this transformation area (Figure 10 and Figure 11). MTAs have become meeting and networking spaces, as mentioned above.

> *"We want climate information to be useful. MTAs are processes that strengthen food security, land-use planning, and adaptation to climate change. At the MTAs, we devolve decision making to people in possession of adequate information; if there were no climate engineers, we would be left only with the technical side."*
>
> Juan Pablo Otero, Director of INSIVUMEH - **Guatemala**

a) Partnerships being implemented through programs and projects encourage the use of MTAs results in the territories and strengthen the entities implementing them.

For instance, in the case of Honduras, the Participatory Agroclimatic Committees (PAC, in Spanish) have active partnerships with *Viaje en Común* and RESCA from CIAT in Choluteca; PROLENCA and GEMA in the west, Early Warning Systems for Agriculture in El Paraíso with the Spanish Cooperation and the Foundation for Climate Investment.

Other examples may be found in Cauca, where MTA are mainstreamed into the AgroCauca Program, where "the MTA becomes the strategy to address impacts in highly vulnerable areas." Similar examples may be found in Boyacá Agro, in the case of this area, or in Nicaragua, where the MTA is part of the SanSeco2 Project.

> *"We are all looking forward to attending the committee and develop the bulletins; we really like this way of having access to the information and take it to the field. Otherwise it would be just my opinion; but now, it gathers the knowledge of all."*
>
> Action against Hunger, **Guatemala**.

Trade unions appoint individuals to follow up on MTAs, as seen in the case of FENALCE in Tolima: *"one of the responsibilities I was assigned three months ago, when I joined FENALCE as a technician, was to participate actively in the MTAs activities."*, FENALCE, Tolima - **Colombia**

Other evidence supporting this change is the preparation of joint bulletins on climate change and variability in agriculture, which is becoming more frequent in the territories. Examples of this may be found in San Marcos, where UNDP and the MTA publish a joint bulletin, and in Chiquimula, where the MTAs includes the results of the Food Security and Nutrition Committee (SAN, in Spanish) in its communications.

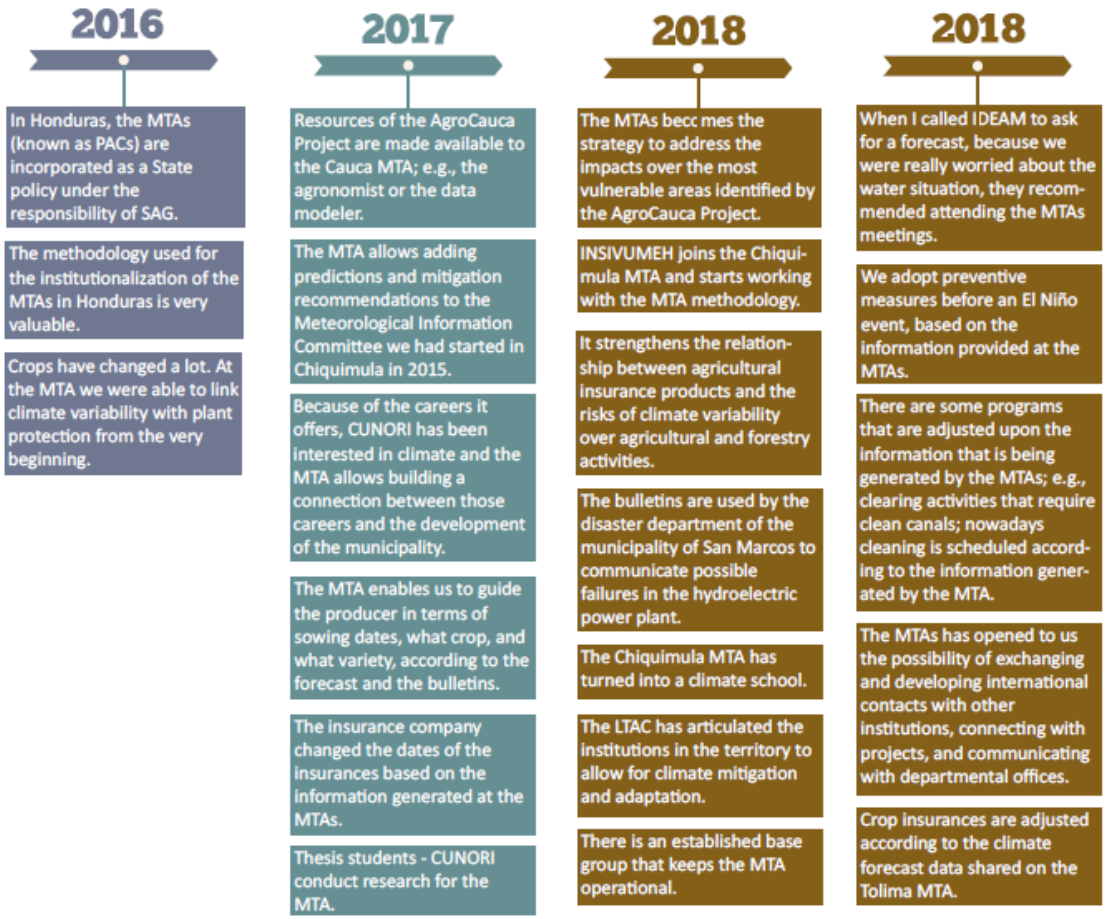


Figure 10. Transformation Area 5: Political advocacy and institutional transformation

A third evidence of partnership and mutual transformation among institutions is observed regarding insurance. In this study we have gathered different cases of new insurances or

modifications of insurances (Tolima, Córdoba, and Guatemala, for example) to be adapted to the information shared at the MTAs.

"We started working on resilience insurances with a parameter-based agricultural insurance for any crop, for medium-sized and large producers, drawing from the work of MTAs in Guatemala."
Martín Leal, Coordinator of the Climate Change Unit at MAGA, **Guatemala**

This symbiotic relationship among programs, projects, and MTAs leverages the local action of all stakeholders. There is only one very important risk when the MTAs sustainability depends on projects.

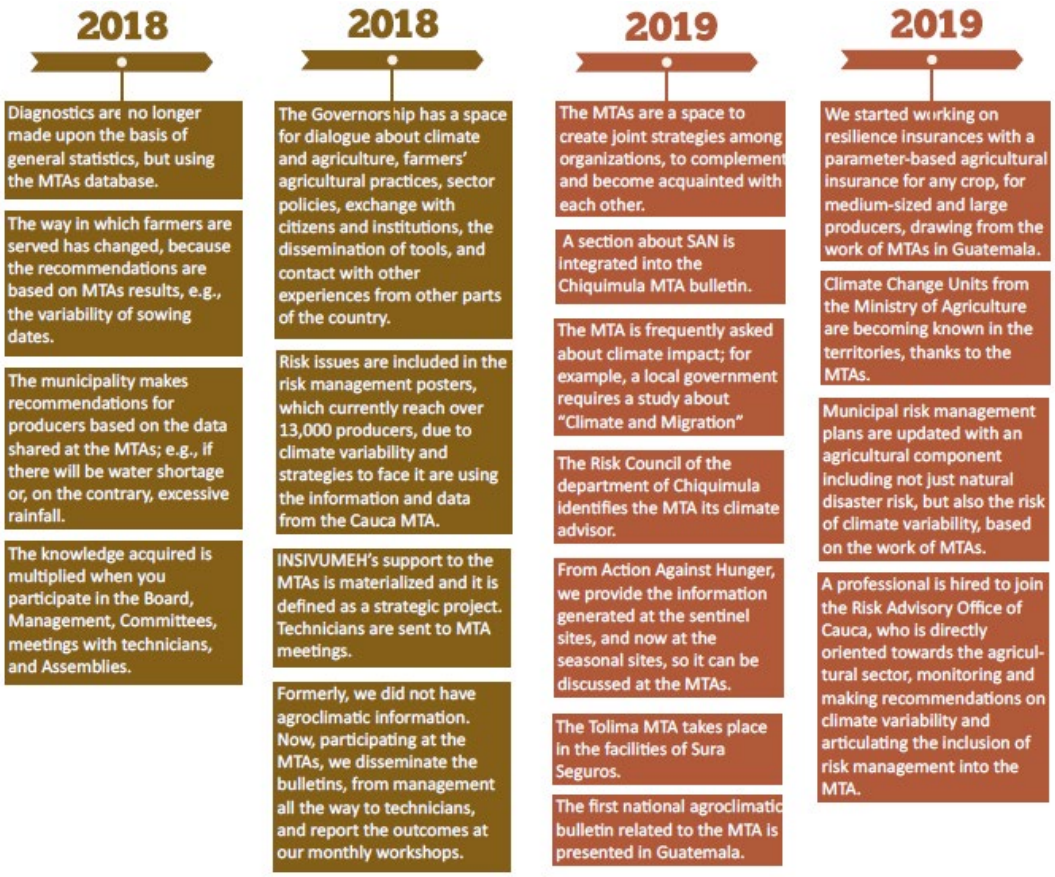


Figure 12. Transformation Area 5: Political advocacy and institutional transformation

"We adopt preventive measures before an El Niño event, based on the information provided at the MTAs. The knowledge acquired is multiplied when you participate in the Board, Management, Committees, meetings with technicians, and Assemblies."

Usocoello, Tolima - **Colombia**

b) Local and national public policies are strengthened and created to adapt to climate change and variability in agriculture

Some examples of this transformation may be observed in Cauca, where *"risk management municipal plans are updated with an agricultural component including not just natural disaster risk, but also the risk of climate variability, based on the work of MTAs."* Moreover, in 2019, an agro-meteorologist was hired to join the office for Risk Management.

Also, at the national level, Honduras stands out for including MTAs (called PACs in that country) as part of the Climate Change Risk Management Policies, mainstreamed into the Annual Operative Plans and appoints the Climate Change Unit of the Secretariat for Agriculture as responsible for the seven MTAs being supported. Each MTAS has its own legal instrument and strategic plan drawn up for all of them.

"MTAs led by SAG are organized in the territories in a multi sectoral fashion, to analyze climate behavior and make agroclimatic technical recommendations, according to prioritized production sectors, in order to warn producers and thus reduce losses in their crops."

Tirza Espinoza, Methodological Process for Creating PACs, SAG, **Honduras**

c) The work of public institutions becomes relevant and appropriate

This evidence has been collected mainly at national meteorological institutions and climate change units of the ministries that find in MTAs a space where information and data become useful at the territorial level and their work is understood by citizens. It is important to mention that this is a relevant change between 2016 and 2020, in which MTAs have played a very important role. In 2016, national institutions responsible for climate were less willing to approach the local level, while in 2020 the commitment and engagement of entities is evident.

"Climate Change Units from the Ministry of Agriculture are becoming known in the territories, thanks to the MTAs."

Martín Leal, Coordinator of the Climate Change Unit at MAGA, **Guatemala**

There are cases in which the MTAs plays an advising role at some public spaces, like the Risk Council in Chiquimula, which refers to the MTA as its climate advisor.

d) MTAs become sustainable

On the other hand, it should be noted that the existence of these partnerships strengthens the work of MTAs, regardless of their leadership model. In many cases, their sustainability and relevance in the territory depends on the creation of networks. One of the methodological steps is stakeholder mapping to create the Committee. In this analysis, the importance of maintaining partnerships at the core of MTAs became evident, as this factor determines their appropriateness (in terms of the usefulness of their trainings, information, and recommendations) and their sustainability (as per the commitment and need of the space, information and the process they generate).

It is important to mention that, despite the importance of networks and partnerships, MTA sustainability is still a major challenge in all territories and all the leadership models, as described in the next chapter. The Outcome Harvesting process found that relationships, partnerships, and joint work have been generated among institutions, companies, associations, and organizations taking part in the MTAs. This has produced a series of beneficial transformations for all stakeholders, such as:

Integration of new populations

There is no evidence of promoting the integration of diverse populations into MTAs. However, it is important to point out this issue for work in the coming years. Some experiences and references have been retrieved and we would like to recover them with the purpose of promoting these work areas soon of MTAs.

INSIVUMEH, specifically the headship of climate research, is very interested in including indigenous populations and generating information in their languages, within the Guatemalan context.

The inclusion of youth is another challenge identified at the Committees. While it is true that youth participation represents approximately 20%, the MTAs do not show any intention of integrating this age group, which could be highly relevant in the implementation of climate change mitigation strategies. In San Marcos, some cases were observed in which sons came to the MTAs along with their parents, and they apply together the MTAs recommendations; they mainly help

in the use of digital tools in their plots. The integration of universities, as in Chiquimula, also encourages the participation of youth at the MTAs.

Other relevant population is women. Their participation also represents 15–20%, except for the MTAs held expressly by them, as in the case of SanSeco2. It has been noteworthy to listen to Ms. Marina González, producer and legal representative of the Association of Farming Families and Fish Farmers from La Mancha de Beré del Torno (Asofasan), in Sucre, **Colombia**, who said that *"the information I receive from the Sucre MTA gives me peace of mind. Women seldom take part. I fell in love with the project; I am enthusiastic, and I do not miss a meeting anymore. Besides, we are in the process of creating the Sucre Women and Climate Change Network, based on what I have learned at the MTAS."*

We found no evidence of any initiative related to the population with disabilities, one of the most vulnerable to the effects of the climate crisis.

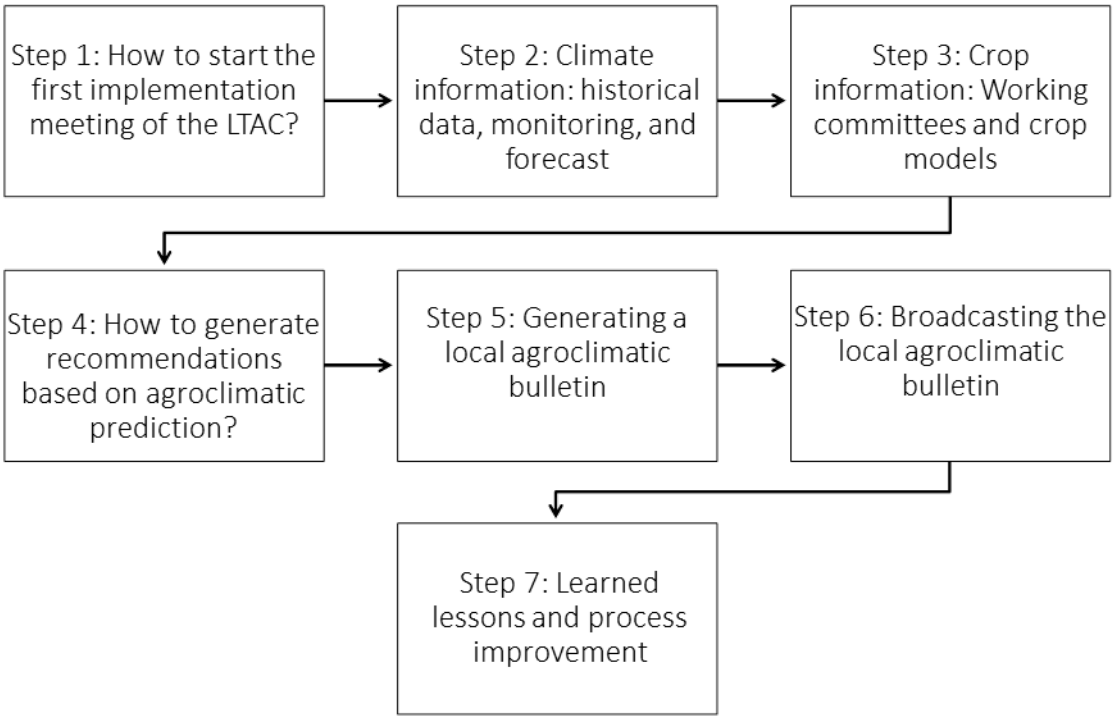
Chapter 2

A methodology with different applications, the sustainability challenge of the MTAs

2. One methodology with different applications, the challenge of MTAs sustainability

One of the most relevant aspects in the 7-year process (2013–2020) of implementing the Local Technical Agroclimatic Committees (MTAs in Spanish) are the strategies used to adapt them to each context in which they have been carried out.

This chapter analyzes the different ways in which the Committees have been implemented, in terms of leaderships, management models, target populations, and communications strategies. It is important to note that the base methodology of MTAs is similar for all the contexts in which it is applied, and with very little variations, it follows the seven steps described in the implementation manual (Giraldo Mendez et al., 2018).



One methodology

The MTAs manual outlines three key components, along with the most important features to be implemented in each context.

- **Component 1:** Implementation process and sustainability by local stakeholders with capacity building.

The evidence collected in this assessment points at MTAs as an open, inclusive, and permanent meeting space. Their regularity encourages local stakeholders to take ownership of the space and in many cases, it becomes a need, as seen throughout the work carried out. This is shown most clearly by the demand of information from technicians and producers, which has been found in almost every territory visited.

The calls for MTAs meetings are usually open and participatory. The average number of individuals attending an MTAs is 25 representatives. For instance, some MTAs are attended by health and education staff to acquire information and training on climate, along with producers, institutional representatives, technicians, and representatives of trade unions. They start with a list that keeps growing from the first participation "snowball", in which data from the new individuals and institutions are collected to be included in the distribution list of the bulletin, the digital chat groups used to disseminate information, the discussion of issues related to agroclimatic issues, and in the call for the next MTA. Discussion groups, digital ones, are a space for the continuity of the MTAs. The participation at the MTAs is very diverse.

> *"A need for the MTA has been created in the territory. There is an increasing demand, not only from the agricultural sector, but also from other sectors: risk management, migration, and health, among others."*
>
> Freddy Díaz, CUNORI, Chiquimula, **Guatemala**.

As shown below, there are some proposals for MTAs targeting only field technicians, or to focus on producers, or on institutions, or MTAs to maintain the diversity of local stakeholders interested in climate. But so far, they are open to every individual and entity willing to participate.

Without a doubt, the evidence shows that MTAs represent a space for local training on issues related to climate variability and their impact on local agricultural production. Every sector and stakeholder interviewed state the MTAs have had an enormous impact on the climate knowledge of those taking part in the face-to-face sessions and, to a lesser extent, on those who receive

information about the MTA results from second or third parties (field technicians and the media, among others). In fact, this is one of the transformation areas arising from the Outcome Harvesting process outlined in Chapter 1 of this document.

> *"For instance, we, the farmers, did not know how many millimeters of rainfall we received; we did not know that Guaranda and Majagual are the rainiest. The MTAs taught us that Guaranda gets less rain, so we rented land there, so we can avoid losses."*
>
> Farmer and member of the Board at FENALCE, San Marcos - **Colombia**

On the other hand, MTAs have been used to develop other trainings for production sectors. Many MTAs incorporate a subject developed by a specialist, or results of field research, or experiments in plots, or some explanation of new public policies, among many other choices. Then, MTAs serve as a training space for the agricultural sector in each territory. This study found that MTAs sustainability is directly related to leadership and the way it is implemented in the territories.

- **Component 2:** Generation of adaptation measures for each region and crop based on local agroclimatic predictions in a participatory manner.

There is an immense added value in the presentation of climate information when the MTA has an expert (meteorologist, climatologist, agro-climatologist, etc.) analyzing the climate variability in the specific context of each territory. This is an outstanding key aspect in all the countries analyzed.

A fundamental feature highlighted by all evidence is that it is essential for the expert to have the ability and readiness to share and teach the participants at the MTAs, as well as the faculty to mainstream other knowledge (e.g., traditional, ancestral, or from other areas, such as risk management, among others) into the contents associated to climate. The MTAs is certainly a space to provide training on climate issues for all participants, technicians, professionals, institutional representatives, male and female producers, and this relies on such technical support.

> *"The MTAs relies on officials from the ministry; at the beginning we thought we had to look for a way to continue, but we do not have enough resources to hire a climatologist. As resources ran out, the MTAs would be put to an end. We could continue holding committee meetings with IDEAM, but we felt we could lose the local analysis. What we are doing is suspending MTAs meetings and, in the meantime, we draft short bulletins, based on data from IDEAM, as a temporary measure."*

Having such an expert is also the most important challenge in terms of investment costs and MTAs sustainability. Not just because it is necessary to have economic resources to hire him/her and afford his/her mobilization among capital cities, since he/she is not usually in the territories, but also, because there is hardly a high availability of experts with the characteristics, training, and readiness required.

Another very important aspect, in terms of climate information, is the possibility of having local readings to complement national readings (from national meteorological institutes) and the use of satellite information. This is not always possible, due to the conditions in the territories: there is a poor availability of local weather stations, or they are in the hands of actors that would not share them; it is not always possible to take meticulous readings in local spaces; station maintenance is expensive and requires follow-up; and the lack of specialists for the analysis often force them to work with national information, which is less likely to be accurate at the local level.

Drafting recommendations by territory and production sector in an inclusive and participatory fashion is one of the core activities of MTAs: the likeliness of sharing knowledge from different perspectives (including farmer knowledge vs. technical knowledge) to draft recommendations to adapt, mitigate, and reduce risk, as well as to strengthen the conditions generated by climate variability in each territory. Over time, recommendations are increasingly elaborate and accurate, according to the evidence found in this study. However, it was determined that in some occasions, MTAs bypass the process of making recommendations based on exchange, and it is left in the hands of technicians or the entity responsible for drafting the bulletin, thus losing one of the most enriching aspects of the MTAs.

- **Component 3:** Dissemination of the agroclimatic bulletin, which should focus on the needs of farmers to facilitate the decision-making process relating their crops.

The bulletin prepared at the MTAs has had an important development throughout the years, on the basis of various elements: mainstreaming more elaborate visualizations, using less technical language to be more accessible to the populations, easily understandable recommendations, compilation of local and ancestral knowledge to complement the technical information, and above all, a great expansion in terms of coverage.

It is interesting to see how bulletins have been the source of different information products, with the purpose of reaching most of the population in the territory, e.g., posters, banners for social networks, mini-bulletins, and radio spots, among many others. There is a need for MTAs to expand the coverage of the information generated. Different strategies for such purpose have been identified, which range from the use of digital media to messages in churches, based on partnerships with parish priests, to the use of social networks, and radio and television programs. The distribution in all territories under analysis is regular through technicians and promoters working in each area.

> *"I have always been among those arguing the most that the information provided at the MTAs has been very useful to us. We did not know how to tackle climate change; now we know. The information has supported our motto of a more resilient Cauca. This has been the most positive aspect. This is what we try to do in the public sector."*
>
> Risk and Disaster Management Advisory Office of the department of Cauca – **Colombia**

A very important aspect highlighted in this study is that the training and information generated by the MTAs is making an impact on the transformation of production practices; these have been implemented on the own initiative of producers who follow the MTAs recommendations included in the bulletins. Examples include the recovery of ancestral practices, transformation of the sector strategy and policies, such as changing sowing dates or upon the recommendation of field technicians and promoters providing technical assistance through rainwater harvesting training.

> *"For instance, I have sown in June-July, instead of April. The date for sowing has changed because of climate. I have also changed my sowing system; previously I sowed more than now; I have changed my methods and theory about sowing. The use of insecticides has changed; the volume of pesticides, fertilizers, and insecticides has been reduced. All this helped me obtaining an increase of one tone per hectare and in my profitability. Nearly everyone has made changes: those who have not attended the committee hear to the story from someone else and follow the lead. I started making changes four years ago."*
>
> Rice producer, San Marcos – **Colombia**

The transformation of production practices is the desired impact of MTAs. In the comparison between the 2016 and 2019 assessments, we see an important change in production practices even in sectors, territories, and specific individuals. It very much depends on how long the MTA has been meeting, its continuity, and its ability to influence key stakeholders. However, this

change in production practices has a demonstration effect of the importance of adaptation measures to cope with climate variability in the agricultural sector in the territories.

Different Applications

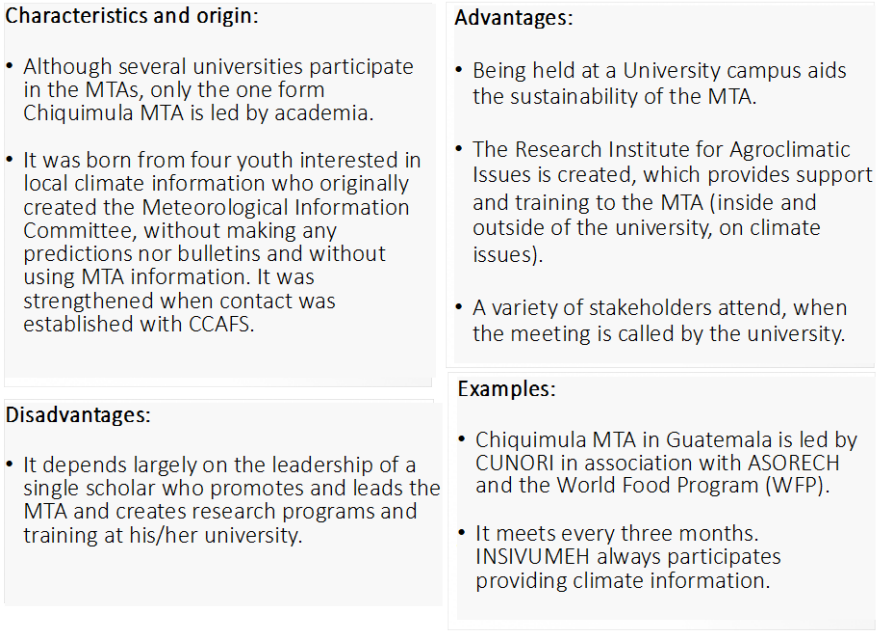
Each context implements Local Technical Agroclimatic Committees (MTAs in Spanish) in different ways. By context, we mean territories, as in each country, the MTAs implementation has its own characteristics, regarding local space. Some elements have arisen and have been selected as the most relevant in the Outcome Harvesting process, in terms of the special features of each site.

a) Leadership and sustainability

The issue of conducting the MTAs is highlighted as a relevant aspect of the implementation. Each territory has its own formula to conduct the MTAs, which depends on aspects such as the interest, political will, available funds, the existence of a project related to the subjects of the MTAs, the existence of a policy or strategy in agriculture prioritizing climate change, knowledge about climate, climate change, climate variability, and agroclimatic issues to favor the promotion of the MTAs.

Five leadership models have been identified in the operation of MTAs and their sustainability. It must be made clear that leadership does not mean flying solo; in every case, the leading entity works in partnership with other entities. But the promotion of the MTAs is mainly carried out by someone who has been identified in this study as the leader.

→ **Leadership from academia:**



This is a very particular experience, as it is based on the interest and promotion provided initially (before MTAs existed) by a group of four youth interested in climate information in their territory, Chiquimula, where they created five years ago (2015), an initiative originally designated as the Meteorological Information Committee, to record data from a weather station they had installed in 2012. Later, the Eastern University Center (CUNORI, in Spanish) of the University of San Carlos joined to complement the work with climate information for agriculture though their Land Management program. This has allowed them to continue working on the subject and be able to promote the MTA jointly with the Mancomunidad, ASORECH, and ANACAFÉ, which are key stakeholders in the implementation of the Chiquimula MTA.

> *"The Committee is backed and led by CUNORI, but now it is able to stand alone; the attendance and the interest are constantly growing. The MTA is becoming a climate school in Chiquimula."*
>
> Freddy Díaz, CUNORI, Chiquimula - **Guatemala**

Advantages and disadvantages: The work of academia has many advantages. In this case, it has been encouraged by the interest and the commitment of individuals working at CUNORI. The institution has a weather station that feeds local data into the MTAs; it has been made possible to incorporate final-year students to work on agroclimatic issues. We are currently in the process of creating an agroclimatic research institute to continue supporting the MTAs through an operational entity. We are also developing a certificate course on the Climate Smart Villages- CSV approach (Aggarwal et al., 2018) with 10 MTAs participants, and we are designing another certificate course in agroclimatic issues.

At this time, the disadvantage identified is that the leadership of CUNORI falls upon a single person in the university. While it is true that the support from the institution is important, it is advisable to create a working group to be able to generate better conditions for sustainability.

→ **Leadership from trade unions**

This is another leadership model, very important for sustainability and the growth of MTAs. It is applied mainly in Colombia, and it has been relevant in the rice sector with FEDEARROZ and in the grain sector with FENALCE. It is often the case that both trade unions share the MTAs work and leadership.

Characteristics and origin:

- The most emblematic case of trade union participation is given by FEDEARROZ in Colombia; it has been a guarantor of MTAs sustainability in rice producing territories.

Disadvantages:

- In this case, the success of the MTAs depends on a single trade union (rice).
- If priorities change in their strategic plans, several MTAS will lack support.

Advantages:

- Fedearroz has integrated agroclimatic themes in their strategic plan. They assure that the MTAs they lead will count with an agrometeorologist who participates reporting predictions and training participants.
- FEDEARROZ did not only focus on rice, but MTAs led by this trade union continue providing support to other production sectors.

Examples:

- FEDEARROZ in San Marcos, Córdoba, and Tolima in alliance with FENALCE.
- Santander with FENALCE.

FEDEARROZ joined the MTAs process since it was launched in Colombia; first in Córdoba, and in 2015, in San Marcos. It has provided support to other MTAs where the rice sector is important,

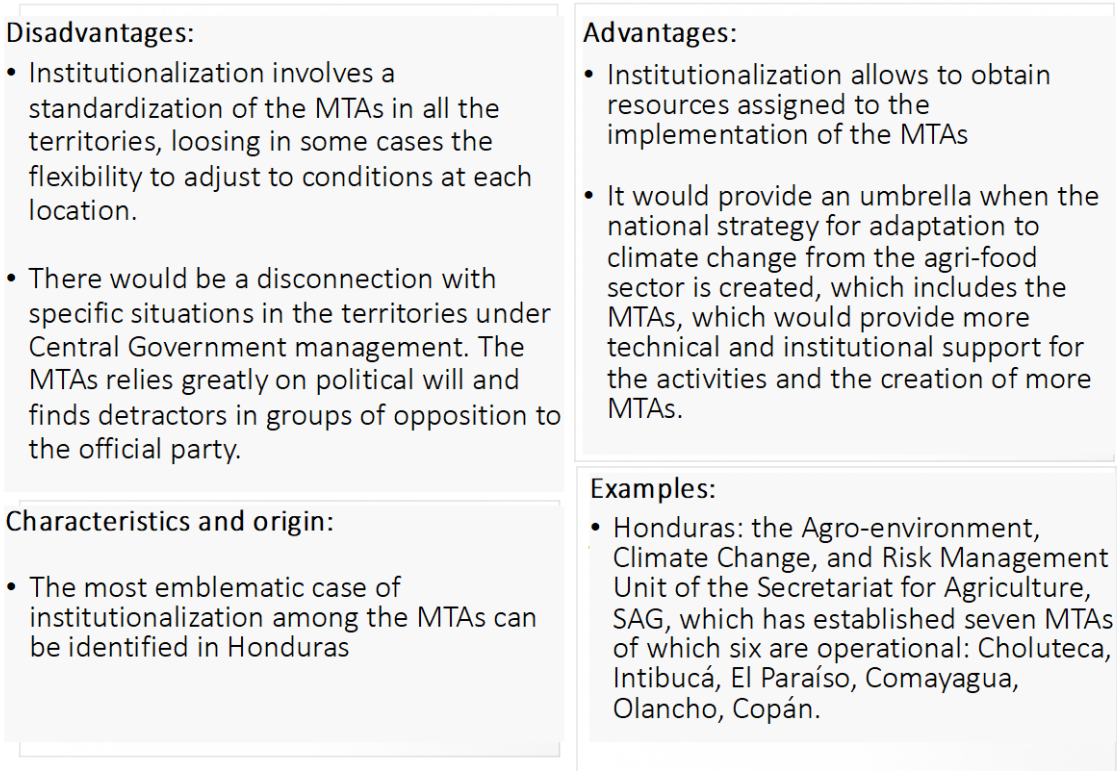
e.g., in the creation of the MTA in Tolima, which is recent (early 2018). Subjects such as climate variability for the rice sector, seed experiments and research, and setting new production practices, among others, have been some of those mainstreamed into FEDEARROZ strategies, which has hired meteorologists to be in charge of the different strategies for the sector, while providing support to MTAs. Even when projects have been completed and the MTAs of a rice region has been left without a climate expert to make the local predictions, FEDEARROZ has undertaken the responsibility to hire an expert, as well as the MTAs leadership to keep it operational. It is important to mention that several trade unions have agroclimatic units for their sector and their members, but still very few of them support the MTAs.

> *"Upon project completion in Cauca, we expected the trade unions to promptly adopt the MTAs, as we have seen in other territories, for their continuity. But this is a different context. We spoke to coffee producers, who are the only large producers in the region, but they told us that they get climate information from Cenicafé, which has another approach: for adaptation, they use climate-smart farms with a cost small producer cannot afford."*
>
> Liliana Paz, Ecohabitat, Cauca - **Colombia**

Advantages and disadvantages: Depending on the prioritized strategies of trade unions represents a major risk. If it is possible to create a link between their interest and that of the MTAs, as in the case of FEDEARROZ, highly significant developments may be achieved in every region, which will have a direct impact on producers of all sectors, as observed in the case of San Marcos, documented in this paper, where there is evidence of a change in practices to address the effects of climate variability, six years after the implementation of the MTAs, with the support of FEDEARROZ. It is worth mentioning that MTAs backed by FEDEARROZ are part of other important production sectors in each region.

→ **Leadership from the national public sector**

One of the possible ways to enhance sustainability is the institutionalization of MTAs. This means that MTAs should be mainstreamed into the public sector as a national strategy for adaptation and mitigation of climate change risks in the agricultural sector.



Two examples of leadership of the national public sector arose in the Outcome Harvesting process. The most well established may be identified in Honduras, where the Agro-environment, Climate Change, and Risk Management Unit of the Secretariat for Agriculture (SAG) oversees promoting and consolidating MTAs in the country. MTAs are included under the umbrella of a national climate change adaptation strategy and in Annual Operative Plans using the standardized methodology for all MTAs established by SAG. This project has received resources from USDA, but in our visit, it was still pointed out that resources to support existing MTAs are scarce and that it has been difficult to continue creating more.

> *"SAG promoted the institutionalization of Committees in the region and established that if it is not regulated, if it is not included in a ministerial decree, it will not be prioritized. At the process level, the methodology implemented is extremely valuable, as it could be scaled up in other Central American countries."*
>
> Diego Obando, Resca-CIAT, **Honduras**

It is important to assess if standardization, such as in Honduras, is advisable to implement MTAs and if it is not contrary to the principle of adjustment to each context.

Another example of MTAs leadership by the national public sector can be seen in Guatemala, where INSIVUMEH, the national meteorological institution, started leading it in 2019, thus it is too soon to regard the implementation of MTAs as a climate change strategy promoted by the institution. There has been contact for mutual learning, especially with the Chiquimula MTA led by CUNORI, to understand the MTAs dynamics and build partnerships for mutual growth. Currently, INSIVUMEH sends a technician to report the climate information of the region to be discussed by MTAs participants.

Based on the experience with the MTA in Chiquimula, the conditions have been set forth to promote other MTAs (Cobán, Petén, and Huehuetenango). It is an approach oriented mainly in joint implementation, unlike Honduras, which is based upon a national guideline.

> *"What I like about the MTAs dynamics is that a group of people and entities meet seeking our information to apply it at the local level. We want the process to continue this way. From our perspective, this is a flagship project we wish to see continued despite the change of government. I truly believe in this process. What I like the most, is that people discuss and question and have conversations with INSIVUMEH representatives."*
>
> Juan Pablo Oliva. Director of INSIVUMEH, **Guatemala**.

Advantages and disadvantages: The main advantage of institutionalizing MTAs to include them in national plans and then in operational plans, is that somehow resources should be allocated, and it would in principle allow for an increased sustainability. There was a substantial investment in the development of a standardized methodology for all MTAs, referred to as Participatory Agroclimatic Committees, promoted by SAG in Honduras. The one-way implementation with standardization by national Government towards the regions is always questionable, as it may provoke local resistance, which was somehow identified by this study in the case of Honduras.

In the case of Guatemala, INSIVUMEH is starting to develop a potential national strategy that had a successful start working together with the MTA in Chiquimula. There is an enabling environment to produce a national action. However, much will depend on the impending change of government. This is precisely another risk of the leadership by national Government, as all will be subject to the agendas and political will of those managing institutions in each term.

→ **Leadership from the local public sector:**

Disadvantages:

- They may depend on the interest of people on official positions for a period, especially when led by positions of trust or by election.
- Being integrated by projects, they are under the risk of being interrupted the moment these projects come to an end.
- Likewise, under the leadership of technical positions, they depend on political guidelines.

Characteristics and origin:

- Local governments have adopted MTAs as a strategy to mitigate the effects of climate change and incorporated them into their policies, programs, and agricultural projects.

Advantages:

- Local problems and relevant stakeholders are well known.
- They have convening power in the territories and resources such as meeting spaces, staff, and equipment to perform the activities of the MTAs.
- They have the potential to generate sustainability when integrated as part of local agricultural and climate change strategies.

Examples:

- The Soil Department of the Secretariat for Agriculture and Rural Development of the department of Cauca included it in the AgroCauca Project.
- The Department of Integrated Rural Development at the Governorship of the department of Boyacá included it in the Boyacá Agro Project.

Examples of this model may be observed in at least two departments of Colombia: Boyacá and Cauca. Local governments mainstream the MTAs into the strategies of some of their departments and offices that have responsibilities concerning agriculture. For instance, in the case of the Soil Department of the Secretariat for Agriculture and Rural Development of the department of Cauca, it is included in the AgroCauca Project and in the case of the Department of Integrated Rural Development at the Governorship of the department of Boyacá, it is included in the Boyacá Agro Project. In both cases, the MTAs and PICSA are included in a project of the municipality.

In the case of Cauca, the Soil Department took over leadership with support from the Ministry of Agriculture of Colombia, which appointed FAO to manage the resources for MTAs. Once these were used up, the Soil Department undertook the responsibility of continuing to produce climate information for producers, but without calling for MTAs meetings. It is important to point out that this is the second time MTAs are suspended in Cauca. The first time, it was being implemented under the leadership of the Río Piedras Foundation with an approach focusing more on watersheds and the communities where this foundation worked, in relation to the CSV strategy. In the next chapter we present an analysis of the two different implementations in Cauca.

In the case of Boyacá, the MTA implementation process is being initiated (2019) under the leadership of the municipality, which is carrying out a project called Boyacá Agro, where climate change and PICSA is a cross-cutting component. The process is under way with the participation of around 30 entities.

Advantages and disadvantages: This leadership model also bears the risk of being determined by the interests and will of the party governing the municipality or department. But it has the great advantage of being in direct contact with the dynamics and challenges facing local stakeholders. This is a very important leadership model combining the commitment and knowledge of local development with the possibility of institutionalizing and formalizing MTAs.

→ **Leadership from the projects**

Several MTAs initiatives in the region are associated to development projects. There is a great advantage in mainstreaming MTAs into projects, because during their implementation period, the necessary resources are available to hold MTAs meetings (including mobility resources for producers), conduct experiments, and explore different methodologies and approaches, as explained to us in Somotillo, where it is possible to have experimental plots as part of the project. This has only been seen under the leadership of a trade union or when a project is being implemented.

"At the MTAs, producers and technicians, the academia, and the public sector share knowledge and experiences. They are spaces where producers, and not institutions, present their experiences, what measures they have adopted, and all the results are shared; for example, we have four climate-smart plots and we present the results at the Committee."

Development Cooperative Federation (FECODESA)

field technical team, Somotillo – **Nicaragua**

Advantages and disadvantages: Although sustainability is included as one of the components of all projects, the evidence collected shows that MTAs are interrupted once projects are completed, such as the case of a project implemented with funds from the Ministry of Agriculture, managed by FAO. The same situation was observed with this project in other territories, like Tolima. MTA interruption has very significant consequences, because, as already mentioned in Chapter 1, there is many evidences of using the MTAs process and products for decision making at different levels: producer families, technicians, and promoters in charge of technical assistance and institutions.

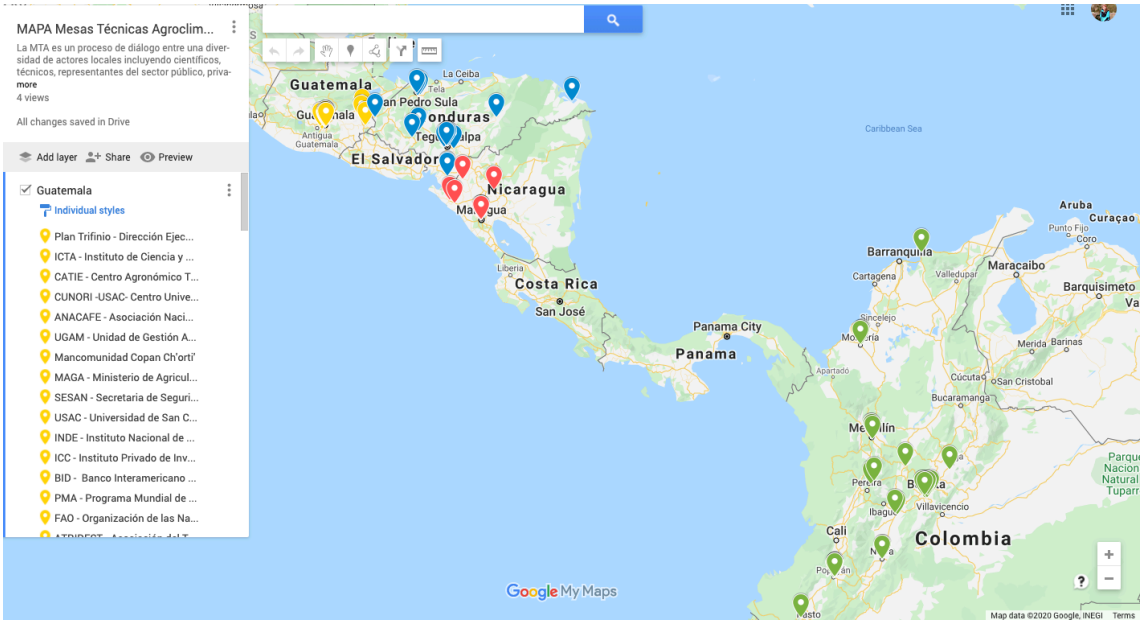
Chapter 3

History of the MTAs and mapping actors

3. MTAs history and stakeholder mapping

To carry out the stakeholder analysis, we have retrieved the history of MTAs in Latin America. The stakeholder mapping in each country has been carried out upon the basis of the attendance list, web pages, and review of institutional files. This chapter is still in the process of analyzing and improving the network by country. Given the amount of information collected, this chapter is a preliminary summary.

For each of the 266 institutions taking part in the MTAs, we have identified the type of stakeholder: academia, public sector, private sector, cooperation agency, civil society organization, and producer organization. We have also identified their role in the MTAs: financing, technical cooperation, participant, production (when it is a producer organization). Below we show the location of institutions taking part in MTAs in the four countries (still under development).



Nicaragua

In Nicaragua, Technical Agroclimatic Committees started in 2016. They were incorporated into a larger project on resilience of the farming family in Nicaragua's dry corridor, which was being implemented with support from IADB-FONTAGRO. Within this framework, they signed an

agreement with CIAT, also in 2016, for technical cooperation on agroclimatic issues and the development of MTAs. They mainly work on maize and beans.

That same year, they acquired 15 weather stations, which received data that were directly sent to a server to be downloaded, analyzed, and presented at the MTAs. They were distributed in Estelí and Madriz in Nicaragua, and in El Paraíso in Honduras, as they make up the dry corridor where the MTAs operate. In early 2017, the training on station installation, maintenance, and interpretation for technicians and promoters began; the MTAs were launched in May that year. MTAS meetings were projected to be held on a monthly basis, but in the case of short-cycle crops, they were held every two weeks.

In the case of Nicaragua, the MTAS methodology starts one day ahead with a field school, where participants monitor crops to assess pest and disease incidence in plants, as well as symptoms of water stress or excess moisture, and other effects of climate change and variability. Field findings are subsequently compared to climate data from the stations. In field schools, participants also work on adaptation and mitigation measures, such as dead barriers, contour planting, cover crops, preventing fires, direct drilling, and others.

They were organized in two cycles. The first MTAs in *primera* (first seeding) in May, June, and July, then in *postrera* (second seeding), in September, October, and November, with producers from the three locations. A total of ten MTAs were held.

The political and social situation in Nicaragua affected the continuity of the MTAs, mainly due to the difficulty of calling and mobilizing producers. During 2018, it was not possible to provide continuity as expected, due to the crisis in Nicaragua, and it was not until September, October, and November 2018 that six new MTAs meetings were held in each location separately. Six bulletins were published. The weather stations did not receive any maintenance over that period, thus some of the data available were not at their best.

These MTAs are held jointly by CIAT, UNAG, Heifer International, Association of Producers of the East (ARSAGRO, in Spanish), with support from FONTAGRO (Figure 12). Although other social and institutional stakeholders were invited to take part, only these four organizations kept on working at the MTAs in the dry corridor.

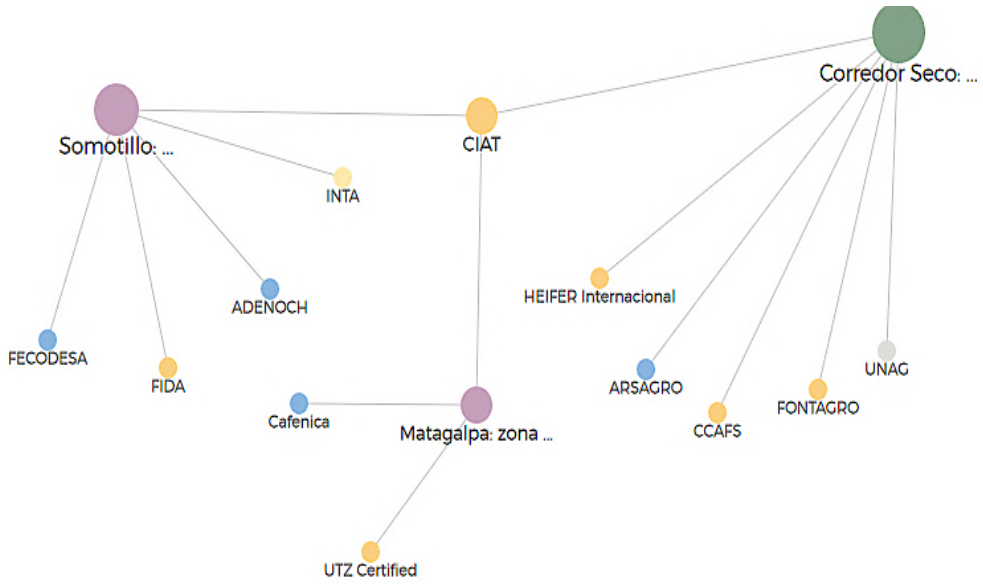


Figure 13. Stakeholder Map – Nicaragua

However, other sectors became acquainted with the results of the dry corridor MTAs. CAFENICA included them in a project supported by UTZ Certified in coffee, and they mainstreamed CIAT's technical cooperation for the development of new MTAs in the coffee-growing area. Weather stations owned by CAFENICA were used; there were three types: automatic stations, such as those in the dry corridor, others containing only rain-gauges that sent the data through mobile applications, and manual stations, where producers sent the data through digital media.

A third location where MTAs have been held is the dry zone, which includes Guatemala, Honduras, and Nicaragua. This is a project funded by IFAD. In the case of Nicaragua, they are held in Somotillo. It involves organizations from SanSeco; Heifer International; the Development Cooperative Federation, FECODESA; ADENOCH; and the National Agrarian University. The official counterpart is INTA. It was financed with funds from SDC. A total of 10 MTAs have been held and it has been decided to create so-called partnerships for learning with FONTAGRO. So, while the project with FONTAGRO was completed on March 4 and it did not achieve all the anticipated results due to the crisis, although it did manage to provide experience useful for other regions: SanSeco and CAFENICA.

In the Somotillo MTA, producers are fairly familiarized with information on the types of seed, crop, and varieties. They know when they face an El Niño year, and that it means rains will be unevenly distributed and the amount of water will be reduced. Some have already indicated they will sow only for subsistence and they will not grow for markets, because that would result in

losses. It has not been possible to engage INETER (the national meteorological institute) in the MTAs processes yet. This has had an impact on organizations, as they are comparing their own stations and making their own climate analyses.

In summary, there are three areas where MTAs have operated in Nicaragua: two in the dry zone and one in the coffee-growing area. CIAT has approached the three areas along with CCAFS. The latter shared the MTAs methodology in the first experience in Madriz, Estelí, and El Paraíso, which was adapted to the conditions of the country and to two additional areas. IFAD, FONTAGRO, and CAFENICA have provided the MTAs with financial and technical support, along with other technical actors of diverse nature, such as UNAG, from academia; Heifer, from international NGOs; INTA, from the public sector; and UTZ from certification agencies. Producer organizations, such as FECODESA, ADENOCH, CAFENICA, and ARSAGRO have been key factors for the implementation of climate change mitigation, prevention, and adaptation measures in the territories.

Guatemala

The first Local Technical Agroclimatic Committee (MTAs in Spanish) in Guatemala was launched in Chiquimula, in the dry corridor, where families lose their maize and bean crops mainly to droughts; there are no water sources, because springs are drying up. Producer families are very much affected by this and have high poverty rates. The Chiquimula MTA was initiated based on a partnership between CCAFS and CATIE, which aimed to create two MTAs in Guatemala.

ANACAFÉ, the Chortí Farmer Association (ASORECH, in Spanish), Mancomunidad Copanch'orti', and the University of San Carlos in Chiquimula had weather stations since 2007. The young technicians in charge of the records often found information gaps. They tried to approach the Ministry of the Environment and other entities to fill in such gaps. This is how they integrated what they called the Meteorological Committee for Chiquimula. Several calls were made, but they received little attention. This initiative was too local, and CATIE and CIAT had not joined it yet.

In 2017, CATIE and CCAFS entered into an agreement and their work took a climate-smart village approach in Chiquimula and Matagalpa. One of the goals set was creating the MTAs and produce agroclimatic bulletins with information specific for a territory. At that moment, they heard from the previous experience and they tried to combine the goals with the young technicians and the initial committee.

They re-launched the Meteorological Committee for Chiquimula in November 2017, in partnership with the founding technicians and 12–15 participating institutions. In March 2018, it started being called Local Technical Agroclimatic Committee (MTA in Spanish), which incorporated the experience of CCAFS. Such experience referred to Honduras and Colombia, where MTAs were already established and operating with similar experiences. The meteorology institute is fully incorporated into the MTA. We consider 2018 as the year the Chiquimula MTA took off. That year, six MTAs were held and four agroclimatic bulletins were produced. In February 2019, the first meeting was held, and the first bulletin was drafted.

The most important challenge at this moment is its institutionalization. It is a very relevant platform, because we are in the Central American dry corridor. However, this requires a lot of support, because we are just starting. Key stakeholders of the Chiquimula MTA are ASORECH and ANACAFÉ, the University of San Carlos in Chiquimula, and the Mancomunidad Copanch'orti', although the latter fell a bit behind, as it depends on international cooperation. The CUNORI University Center, and its Land Administration School, is currently the MTAs coordinator.

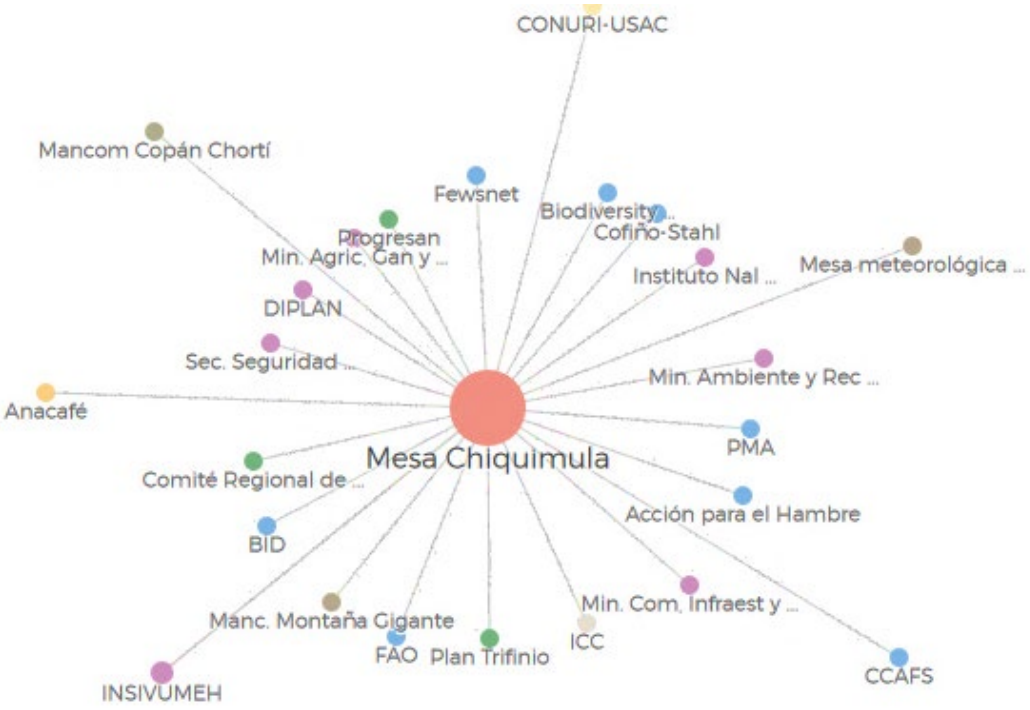


Figure 14. Stakeholder Map - Guatemala

The CCAFS-ASORECH partnership is also a key factor for the operation of the MTAs. They have been able to call up to 24 organizations (Figure 13).

Honduras

On late 2013, CCAFS made an initial approach to the Secretariat for Agriculture and Livestock to provide support to the agrifood system. The possibility arose of an exchange visit to Africa, where the Local Technical Agroclimatic Committee (MTA in Spanish) process was already operational. This visit was carried out in 2014. In addition to this, there was an exchange of experiences with Colombia, which contributed to refining the initiative that was materialized in mid-2016, with support from the Secretariat for Agriculture (SAG), some available funding, and staff able to address the subject. SAG has been leading the Participatory Technical Agroclimatic Committees with support from CCAFS and CIAT.

SAG published its national strategy for climate change adaptation and created the environmental management unit to address the subject from the public sector and at an institutional and public policy level. An MTA model was developed in Honduras as well as a methodology that is based on a hybrid of various experiences and it consists of the following steps:

1. Conduct a vulnerability analysis and draft an adaptation plan for a territory. The territories are determined by State policy: The National Vision Plan. The MTAs are based on this regional approach and there are 16 development regions. Regions have SAG regional offices, which facilitates following up on MTAs actions.
2. The initiative is presented to multiple stakeholders related to the agricultural sector and it is proposed to create an MTAs. Its aim is decision making, planning, and action. Experiences are presented at the MTAs.
3. There are 7 MTAs in Comayagua, El Paraíso, Intibucá, the Gulf of Fonseca region, the western region, Santa Bárbara, and Olancho. Each one has its own structure, mission, vision, and drafts a work plan. They have proceeded at a different pace and they have their own way of making progress; they are based on their own strategic framework and an internal code for a one-year period. They include activities such as awareness-raising campaigns, actions specifying who is in charge and their timeframe, and regular meetings, among others.
4. A general MTAs internal code is drafted to elect a board of directors, duties, and layout of sessions, among others.
5. MTAs are covered by a ministerial agreement that grants SAG the power to create MTAs with legal support. MTAs are integrated by multiple stakeholders, such as government

representatives, civil society, private companies, academia, trade unions, cooperation projects, and local governments (Figure 14).

There are two major events that take place every March and August, aimed at climate training for agriculture and livestock technicians. They have been jointly organized with Infoagro, CENAOS-COPECO, and SAG, for five years. These are meetings held before the production cycles start and are based on field trips with a focus on climate. They are organized in *postrera* and *primera* to generate recommendations for the main production sectors across the country. MTAs play a very important role in these meetings in terms of information for decision making.

The information is laid down at the MTAs by production sector. The adaptation plan has prioritized the potato, rice, livestock, cocoa, and basic grain sectors, according to the region. For each sector and region, agroclimatic recommendations are prepared for the production cycle. A discussion is held in the plenary session, and then it is transferred to SAG with the meteorological information to prepare the bulletins by region and by sector. This has allowed them to have more accurate information for every region.

In 2018, one of the regions engaged in the exercise of producing a crop model and a sowing-date calendar was prepared using the CropWat tool (FAO) to be more precisely targeted, according the dates and climate conditions.

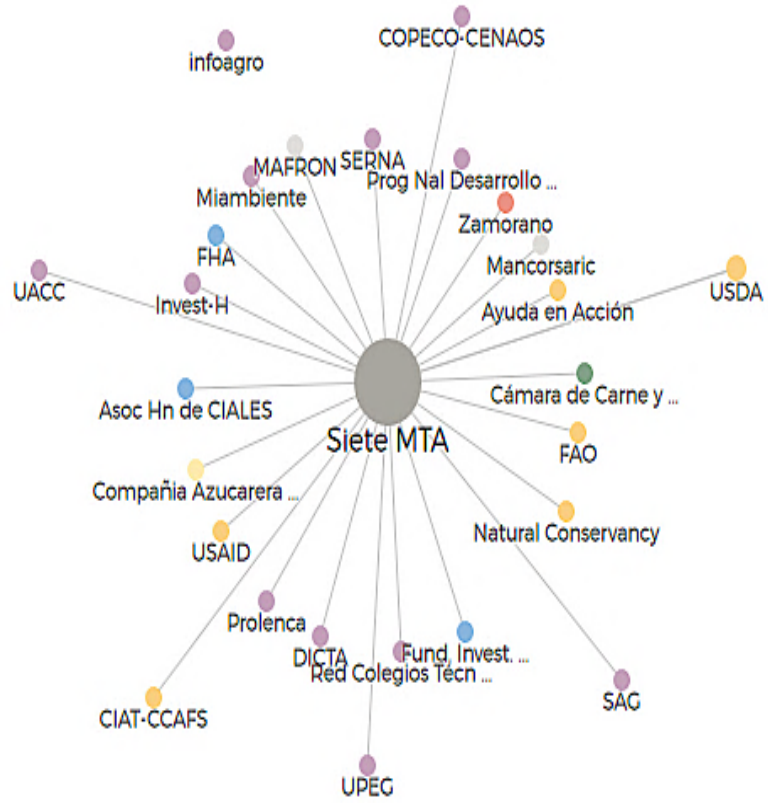


Figure 15. Stakeholder Map – Honduras

Chapter 4

Producer Families Benefited from MTAs

4. Producer families benefited from MTAs

It is necessary to know the populations being served by Local Technical Agroclimatic Committees (MTAs in Spanish) in Latin America, especially, the number of producer families. We have estimated that around 243,432 families have been served by the MTAs analyzed in this chapter. However, in this consultation process, it has been made clear that, despite it is in the interest of all stakeholders, obtaining this information is not an easy task. Here we present a summary of information that is still undergoing analysis, due to the following reasons:

→ A record of the number of farmers receiving the MTAs information is not being kept. The records available are the attendance list of MTAs meetings, which are mainly the representatives of entities, besides the number of participants in the WhatsApp lists.

→ It is very hard to quantify the viral or "snow-ball" effect produced through digital tools, which is the main means of communication, according to the evidence gathered in this study. Quantifying the number of persons receiving viral information is a complex task, not just in the case of MTAs, but in general.

→ Climate change and agricultural projects (either public or private) in the areas in turn use the results of the MTAs, either because they take part in them, or because they have access to the information through third parties, even if they do not participate. Consequently, it is difficult to know the total number of producer families receiving and using MTAs results.

Taking this situation into account, we have estimated the number of farmers receiving information from the MTAs we visited, using the following strategy:

→ MTAs leading and coordinating entities have been asked if they have any kind of data about the population that has access to the MTAs results.

→ We have reviewed the lists of participants and digital chat lists from the MTAs we visited.

→ When necessary, because there are no data, we have used a low viral rate of 0.6. This is an intermediate viral effect, considering the conditions in the rural area, in which MTAs take place in the region, but also considering the evidence that a significant amount of producer families make an intensive use of WhatsApp, the tool used to send the information.

→ We have interviewed technicians and promoters of partnering projects in every region we visited, to become acquainted with the way information is distributed and the number of families receiving it.

Based on this, we have estimated an approximate number of producer families receiving the information generated for each one of the MTAs visited, in the cases where this information was not available from the leaders of the MTAs. Whenever there is a number reported, it means we have taken the data provided.

1. **Guatemala:**

CUNORI, the coordinator of the Chiquimula MTA, reports a total of 4,000 producer families and 50 technicians, who receive the MTA information directly through different media (technicians, bulletins, local media, and chats, among others). Each technician reported serving around 50 families. If we use the viral effect (i.e., that families forward it to other families), we assume a total of 6,800 producer families.

Considering that the MTA in El Progreso is too recent, but with an important dynamic of participation, it is estimated that it distributes information to two thirds of the equivalent of Chiquimula, i.e., to 3,000 producer families. If we assume a viral-effect rate of 0.4, for being more recent, it would be reaching 4,800 families. Totonicapán-Quetzaltenango and Center-South are two recently established MTAs, like El Progreso, thus we can assume a similar behavior, i.e., 2,000 producer families. If we assume a viral-effect rate of 0.4, each MTA would be reaching 2,800 families.

2. **Honduras:**

In this country, the Climate Change Unit at SAG reports that 28,000 producer families are receiving information from the seven MTAs currently operating. Using a viral-effect rate of 0.6, they would be reaching 44,800 families.

3. **Nicaragua:**

Promoters from FECODESA provide information face-to-face to 650 producer families in Villanueva and Somotillo. Promoters from ADENOCH distribute information on a face-to-face basis to 200 producer families in Las Marías, and 25 female promoters gather women heads of household to share the information with them. These 850 families make it viral to 510, using a 0.6 average rate of viral effect. This makes a total of 1,360.

The WhatsApp group has 45 participants, whose viral effect takes the second round to 72 producer families. These two local organizations reach approximately 1,432 families. On the other

hand, Heifer indicates that it has managed to benefit 2,000 families with the agroclimatic information from the MTAs through technicians and media, such as community radios. The viral effect would reach 2,800 families. This results in about 4,232 beneficiary families from the MTA in Somotillo.

4. **El Salvador:**

The MTA in San Miguel could not be visited, but according to interviews, it is considered to operate similarly to Somotillo, in terms of information distribution through promoters and WhatsApp lists, but with a very important support from the local government, which makes it similar to Boyacá. Taking the two aspects into account, as well as the recent establishment of the MTA, a total of 3,500 families is projected to benefit from the MTA information.

5. **Colombia:**

Tolima: the coordination of the MTA in Tolima reports 1,250 families benefiting from the bulletin via WhatsApp and other electronic media in the first round. With the viral-effect rate being used, the results show that 2,000 families have benefited through electronic media. Participating institutions distribute the information among 5,000 families through other means, such as printed media, blackboards, etc., which with a viral effect reaches a total of 8,000. This makes a total of 7,000 families in Tolima.

Sucre: In the case of Sucre, the number reported is 8,000 producer families benefiting from the bulletin through different media. The viral effect reaches 12,800 producer families.

Córdoba: In the case of Córdoba, the number also approaches 8,000 producer families. The viral effect reaches 12,800 producer families.

Boyacá: In the case of Boyacá, the WhatsApp list has 85 participants, who distribute the information to at least 20 people each, according to interviews, totaling 1,700 families. In addition, there are 60 liaisons and promoters, either from local government or projects (such as PICSA), which share the information with at least 20 more families, for a total of 1,200. This makes a documented record or 2,900 families, and we must add the information broadcast in local radios, which projects the number to 4,000 with a viral effect that results in 6,400 families.

Cauca: MTA in Cauca uses multiple combinations of media and reports that the information reaches 40% of the rural population in the territory to amount a total of 477,019 people. If we assume each family has an average of five members, it would be reaching a total of 90,000 families in Cauca, due to the diversity of media in which information is shared. An advantage of Cauca over other regions is a notable communications strategy that results in a wide range in terms of MTA information dissemination.

For **Magdalena, Caldas, Santander, and Nariño**, we will use a projection like MTAs with a comparable operation, in terms of information dissemination. This means they will be like Sucre and Córdoba, for a total of 12,800 producer families receiving MTA information. Caldas, Santander, and Nariño are like Tolima and Boyacá, with an average of 9,000 families served.

Families receiving MTAs information in Latin America (conservative data)		Source
Guatemala		
Chiquimula	6,800	Interviews to MTA participants and leaders
El Progreso	4,800	It does not have a projected number, but in an interview with the MTA leader, we got a projection
Totonicapán and Quetzaltenango	2,800	Based on time, dynamics, and review of attendance list, it is assumed to be similar to El Progreso
Center-South	2,800	Based on time, dynamics, and review of attendance list, it is assumed to be similar to El Progreso
Honduras		
Seven MTAs in Honduras	44,800	Interview with UCC&GR, which reports a projection of 28,000, plus viral effect
Nicaragua		
Somotillo	4,232	Interviews with leaders and participants on the dynamics to reproduce information
El Salvador		
San Miguel	3,500	Review of lists; interview with leaders
Colombia		
Córdoba	12,800	Review of lists; interview with leaders and participants
Sucre	12,800	Review of lists; interview with leaders and participants
Magdalena	12,800	Interview with expert meteorologists in charge of identifying the current dynamics
Caldas	9,000	Interview with expert meteorologists in charge of identifying the current dynamics
Santander	9,000	Interview with expert meteorologists in charge of identifying the current dynamics
Cauca	90,000	Review of lists; interview with leaders and participants. Information provided by local government, which coordinates

		the MTAs, and verified with different sources and the implemented communications strategy.
Nariño	9,000	
Tolima	9,000	Review of lists; interview with leaders and participants
Boyacá	9,300	Review of lists; interview with leaders and participants
Total of producer families	**243,432**	

As a preliminary synthesis, we may say that the MTAs analyzed are benefiting at least 243,432 producer families, according to the evidence collected. Some MTAs have been using 40% as the proportion of families receiving the information that make changes in their production practices. If it would be the case, that would mean that 97,372 families have changed their production practices as a climate variability adaptation measure, thanks to the work conducted by MTAs in the region.

As mentioned above, this has been a complex calculation, because, on the one hand, MTAs are not following up on the beneficiary families, and on the other, because it is very complex, due to the diversity of means to transfer, duplicate, and make information viral. However, based on the experience obtained with this work, we would propose a formula that could help to get closer to the actual figure. It would take the following into account:

a. Families associated to the trade unions or organizations leading the MTAs. (G)

b. Families taking part in a project participating at the MTAs, either from local governments, local, or international organizations. (P)

c. Families served by promoters, technicians, etc. (T)

d. Families participating at the MTAs (the least) (M)

e. Families joining digital discussions, mainly in WhatsApp (W)

A preliminary analysis of the information shows that 90% of these families are receiving the information from the MTAs; the information, data, recommendations, etc. have become available resources and they are shared in the territories. On the other hand, it is known that there is a constant replication of the information, either by word of mouth, traditional media, or digital media. Reviewing different models, we can assume that the viral effect makes information grow at a rate of 0.6, especially via chat, word of mouth, and traditional media, and not through social networks. The latter, because producer families do not make an intensive use of social networks (mainly due to the age of their representatives), and also because the MTAs information for the

farmer is not shared in social media, just via WhatsApp, according to the evidence collected in this study.

Taking this into consideration, the number of families served by an MTAs could be calculated as follows:

Families served (FA) = ((N1*G + N2*P+ N3*T+ N4*M+ N5*W) *0.90) + (((N1*G + N2*P+ N3*T+ N4*M+ N5*W) *0.90))*0.6

For this, we conducted a survey with organizations, trade unions, and promoters working on the territories, and attending the MTAs, indicating the number of families associated or served by them. On the other hand, according to the evidence generated by this process, 40% of families receiving information from the MTAs modify their production practices to adapt to climate variability and mitigate or adapt to the effects of climate change.

Families with changes in their practices (FCP) = *FA*0.4*

This method to calculate the number of families served and families with changes in their practices facilitates the estimation of families benefited by MTAs.

Conclusions and Recommendations

The purpose of the Outcome Harvesting approach is to understand the transformations being generated by the actions implemented under real conditions. With this purpose, an emerging theory of change is built, i.e., it is created upon the basis of the evidence of transformations obtained through the process of inquiry. Unlike other approaches, where theory of change is based on project design, the Outcome Harvesting process builds it upon different implementation points, as it arises from the transformations being produced. This allows the comparison among theories of change emerging over time.

From the Outcome Harvesting process described in Chapter 1, five major transformation areas emerged, along with nine strategies that are contributing to the development goal of Local Technical Agroclimatic Committees (MTAs in Spanish) in Latin America. The resulting theory of change would be the one shown in Figure 15.

According to this assessment, MTAs are contributing to their overarching purpose through five transformations: 1) increasing the credibility of local climate information, 2) communication of climate information that is more understandable and more connected with the reality of each territory, and reaching more people in the location, 3) the democratization of agroclimatic

knowledge, 4) the transformation of production practices that reduce the risk of producer families, and 5) the political advocacy and institutional transformation.

Based on the evidence collected, the transformations in these areas are being achieved by the advances made in the strategies being implemented:

1. Advances in the generation of climate information at the local level by national meteorological institutes.
2. Advances in local initiatives generating agroclimatic information at the local level.
3. Strengthening of a simpler and more educational communication of agroclimatic information.
4. Increasing the commitment of meteorologists to make agroclimatic information more accessible at the local level.
5. Enhanced application of agroclimatic information to local needs.
6. Increased strategies to disseminate MTAS results.
7. The spontaneous emergence of communities of practice on agroclimatic issues at the local level.
8. Increased use of the information generated at the MTAs for decision making.
9. Strengthening the agroclimatic knowledge of producer families.
10. Strengthening the agroclimatic knowledge of local promoters and technicians.
11. Creation and preservation of a local space to bring stakeholders together for the creation of partnerships and networking at the local level.
12. Creation and preservation of a local space for training on agroclimatic issues.
13. Mainstreaming MTAs actions into projects, programs, policies, and measures being implemented at the local level.
14. Strengthening and creation of a local and national public policy on climate and agriculture.
15. Strengthening the relevance and knowledge of public institutions focused on climate issues at the local level.

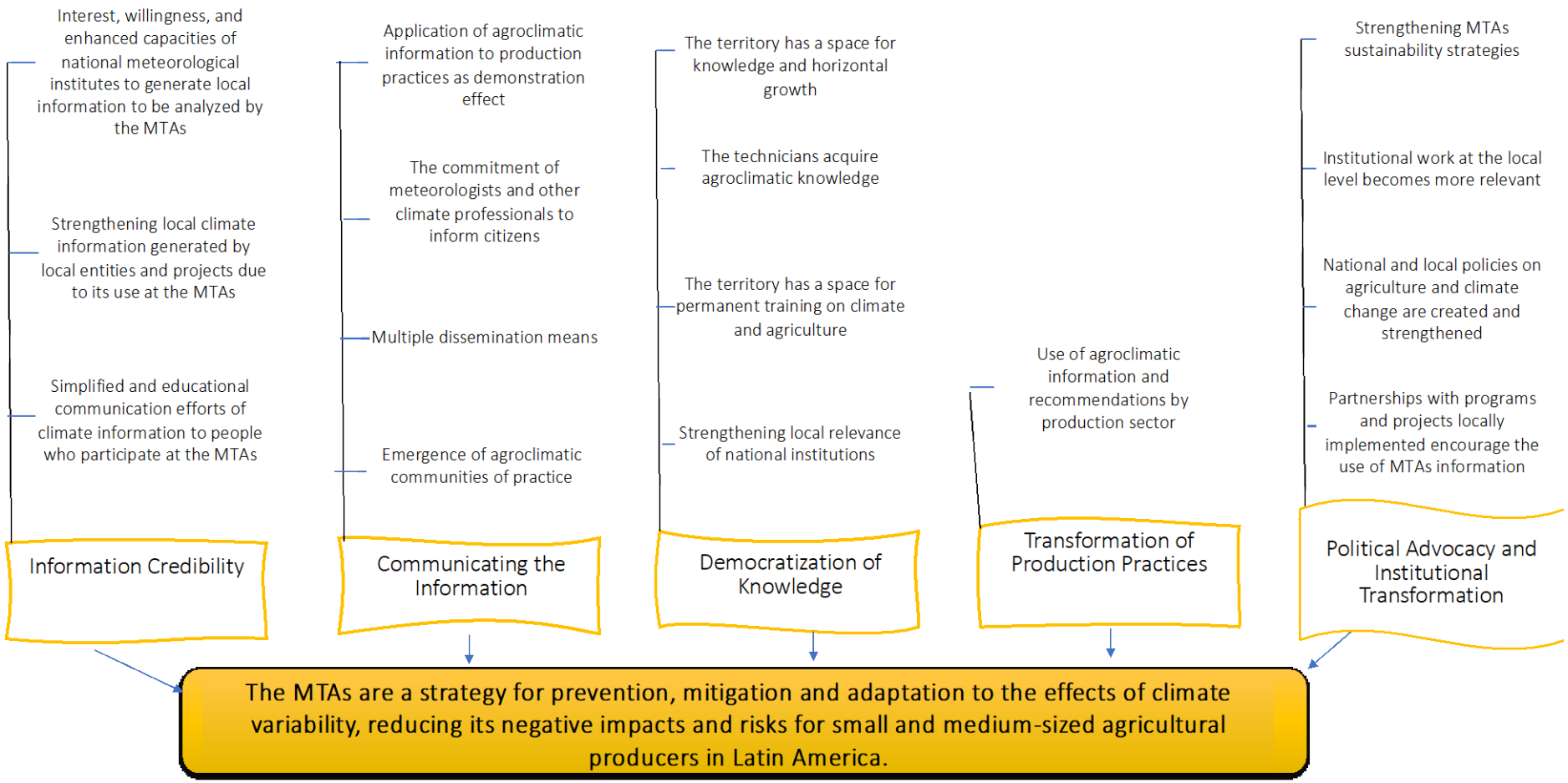


Figure 16. Theory of change at Technical Agroclimatic Committees as of 2019

Strengthening the sustainability of MTAs upon the basis of local networks.

As shown in the stakeholder maps, Local Technical Agroclimatic Committees (MTAs in Spanish) are spaces that gather multiple actors, including: 1) local private sector, 2) trade unions, 3) national public sector, 4) local public sector, 5) local academia, 6) international organizations, 7) local organizations, 8) groups and associations, and 9) producer families.

It is important to mention that despite the advances in the MTAs in Latin America, their scope of action and coverage is still limited. One of the most widespread recommendations of the stakeholders consulted is the need to increase participation in MTAs. The attendance reported in all Committees is 20–30 individuals, except when a special activity is being held. In the next phase, it will be necessary to define strategies to scale them up in the territories, so that the core meeting does not become unmanageable. Some of the suggestions have been related to decentralizing them, either by holding local MTAS meetings in addition to the core meeting, or by rotating the MTAs in different locations within the territory.

While it is true that the strategies to communicate and disseminate MTAs results have diversified, this has not been the case for all MTAs. It is important to share the different communications strategies and bulletin by-products used among MTAs, so they can be widely replicated. There is still much room in all territories to make MTAS results accessible for all producer families, either by improving their access or understanding. It is important to provide MTAS promoters with training on this issue. It is important to mainstream the use of digital tools to disseminate MTAs results into the methodological steps that support them, particularly due to the spontaneous emergence of communities of practice in local agroclimatic issues, as a result of their participation in the MTAs.

It has been shown that mainstreaming the MTAs results into existing programs and projects multiplies the impact of both initiatives. We recommend strengthening the existing partnerships, as they can be further developed. As mentioned in Chapter 2, MTAs sustainability is still a critical issue that had not been resolved yet at the time we conducted this assessment. MTAs are significantly affected when they are interrupted; this happens more often when they depend on a project. Although this has been an issue addressed before, it has not been resolved yet, and it affects a process that is relevant for the communities, their organizations, and producer families. Sustainability strategies are context-specific, but they have not been consolidated yet.

Calculating the number of families benefiting from MTAs has been extremely complex. There are few mechanisms in place to follow up on this figure. We have attempted to calculate the number of families receiving information from MTAs, but due to the viral effect of messages sent via digital media and word of mouth, both very important in the area, it is difficult to find out how many. On the other hand, we have the number of families that have modified their practices, which have not been counted at the MTAs either, but are associated to projects, the demonstration effect, and word of mouth. Some of them have made some very general estimates. An approximate figure collected in discussions with several stakeholders indicates that 20% of families receiving MTAs information have made changes in their production practices.

There is a significant demand of more local weather stations to be installed to improve the chance of monitoring climate variability in the MTAs. Stakeholders request maintenance for stations, as well as accuracy in readings, clearly understanding that their interpretation requires knowledge, among other aspects. The interest in having more local weather stations was expressed by all stakeholders consulted, ranging from producer families to national meteorological stations.

In countries where there is no commitment from government institutions, there is a growing demand for involvement. In some countries, government institutions have been involved for certain periods, in some others they have not been involved yet; in others they are starting to participate, and in others there is full involvement. This is relevant, due to the need of having official local climate information available in the territories to be able to connect all MTAs with national strategies on climate change, agriculture, food security, risk management, and poverty reduction. There is an urgent need to continue working on national and local policy advocacy for MTAs to become national strategies, while maintaining their features.

A recurring demand during stakeholder consultation is the need for MTAs to be able to explore solutions of the local agroclimatic issues, through experiments, research, etc., which could be carried out by MTAs participants. This could constitute a next step in the design of MTAs. This proposal aims to offer more solutions to local climate issues through research results.

Another recommendation generated from our process of inquiry was encouraging the participation of other populations. Special mention was made of the involvement of youth and women, which currently show little presence. For this purpose, it is necessary to develop strategies addressing cross-generational and gender issues within the MTAs. An additional recommendation pointed out is the need of building indicators to monitor and evaluate MTAs.

There is no consensus on several aspects regarding MTAs in different contexts. The most outstanding aspects include:

a. **Who should lead the MTAs:** the civil society, academia, municipalities, and local networks are some of the suggestions.
b. **Target audience:** for some stakeholders consulted, they should target mainly technicians; for others, producer families. Others have mentioned public institutions and other individuals, so they maintain their multi-stakeholder nature.
c. **Formalization:** for some stakeholders, formalizing the MTAs is necessary, and even a legal status has been proposed; for others, it should be kept as a network of interested parties, something less formal.

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Annex 1

Transformation Area 1: Confidence in the quality of climate and agroclimatic information at the local level.

When?	What?	Who makes the change?	Importance	Source
2019	95% of accuracy in climate predictions in Cauca.	Secretariat for Agriculture of Cauca	People start trusting MTAs predictions	Juan Diego Otero, Soil Department of the Secretariat for Agriculture and Rural Development, Cauca
2019	At the last MTAs, INSIVUMEH offered rain-gauges to place them in areas different from Esquipulas and Zacapa, to have more information; they will be placed in San Jacinto, Chiquimula, Olopa, Jocotán, a second location in Esquipulas, and another one in Camotán.	INSIVUMEH, Guatemala		Claudia Menéndez, INSIVUMEH, Chiquimula
2019	We were using the IDEAM bulletin. Now we know it contains more general information, unlike the MTAs, which lays down information of each territory, so we know what is going to happen.	Producer families		Robert Álvarez, PICSA promoter and farmer, Boyacá
2019	We receive climate information adapted and understandable, which we didn't have before.	Participants in the Boyacá MTA		Leonardo Becerra, Rural Director of Integrated Rural Development at the Governorship of the department of Boyacá
2018	The INSIVUMEH bulletins went from stating northern region or southern	INSIVUMEH		Martín Leal, Coordinator of the Climate Change Unit at MAGA, Guatemala

	region, to describing conditions for the municipality.		
2017	The information for the MTA is collected from four stations of ARSAGRO and 12 of MiAmbiente. It is shared with CENAOS, which has additional data and prepare everything for the Committee.	MiAmbiente	Rodolfo Rodríguez, Field Technician, Regional Association for Agricultural Services, ARSAGRO, Honduras

Transformation Area 2: Knowledge, Understanding, and Connection of Agroclimatic Information.

When?	What?	Who makes the change?	Importance	Contribution of the MTAS	Source
2019	Less technical agroclimatic bulletins are prepared to be more accessible to the general public.	University of Tolima	It makes the information more accessible to individuals without a technical background.	It contributes to improving the bulletin, making it simpler.	Luis Lastra, Sura Seguros Tolima
2019	The bulletin is broadcast in 15 community radios, UMATA radio stations, commercial broadcasters (Cauca Radio, Fe Colombia, and Radio Súper), local television, local newspapers, social media, the Secretariats for Agriculture, risk management coordinators, churches, and the army in Cauca.	Secretariat for Agriculture of Cauca	There is a process for communicating and ownership of the widespread bulletin using different means.	The Cauca MTA makes a strong emphasis on the communication and ownership of the bulletin in the department and its dissemination through different means.	Juan Diego Otero, Soil Department of the Secretariat for Agriculture and Rural Development, Cauca

2019	Mini-bulletins are produced by crop to be distributed to producer families via social media and chats.	Secretariat for Agriculture of Cauca	New ways are being devised to communicate agroclimatic information and the 10 recommendations from 11 MTAs.	The MTAs has different resources to communicate its recommendations, forecasts, and predictions.	Juan Diego Otero, Soil Department of the Secretariat for Agriculture and Rural Development, Cauca
2019	A basil-producing family disseminates the bulletin to see the forecasts.	Producer families	The information contained in the bulletin is mainstreamed into the decision-making process of producer families.	The bulletins are increasingly accessible to producer families.	Mauricio Yepes, FENALCE, Tolima
2019	We have a WhatsApp group that works for advice and technical assistance. If the producer notices a pest or disease, he (she) uploads it to WhatsApp and everyone starts assisting him (her).	Producer families			Natalia Centeno Rivera and Juan Carlos López, Development Cooperative Federation (FECODESA) technical team, Somotillo
2019	Families are looking forward to receiving the bulletin via WhatsApp, MSM, or printed.	Producer families			Natalia Centeno Rivera and Juan Carlos López, Development Cooperative Federation (FECODESA) technical team, Somotillo
2019	I distribute the bulletin through WhatsApp to at least 50 contacts, which redistribute it to at least 20 contacts, and so on.	Producer families and FENALCE	The MTAs information is distributed to a growing number of producer families using digital media (mainly WhatsApp)	A bulletin is prepared, which can be distributed via digital chats.	Mauricio Yepes, FENALCE, Tolima

2019	Audios or spots from the MTAs started to come up, the take ownership of the information and transform it into audios that are shared via WhatsApp.	Participants in the Chiquimula MTA			Rosario Gómez, Head of the Research and Climate Services Department, INSIVUMEH, Guatemala.
2019	The WhatsApp group is very useful. We share very relevant information, useful for the work of the institution.	Action against Hunger			Luis Melgar and Fernando Portillo, Action against Hunger, Guatemala
2019	There is a newly awakened interest in learning more about agroclimatic issues at the Chiquimula MTA; we all wanted to participate in the specialization.	Action against Hunger			Luis Melgar and Fernando Portillo, Action against Hunger, Guatemala
2019	The WhatsApp group is very active; there are technical discussions of climate, agriculture, problems arising from climate change, technical advances, field days, etc.	MTAs stakeholders from Córdoba	A trustworthy space has been created for agroclimatic issues in Córdoba.	The MTAs creates a permanent space for face-to-face and digital exchanges.	Alejandro Arames, FENALCE, Córdoba
2018	We have a permanent discussion group, where we are all united and where producers are always very interested.	Participants in the San Marcos MTA	There is a local space for interaction on climate in the region.	The MTAs creates and boosts a WhatsApp group with agroclimatic information and many other resources relating to it.	Fabian Enrique Rodríguez Jiménez, Rice Advisor at ICA, San Marcos
2018	There has been a shift from very general predictions to a highly detailed degree of specificity and very accurate.				Juan Diego Otero, Soil Department of the Secretariat for

					Agriculture and Rural Development
2018	We entered into a partnership with Fe Colombia and we are training soldiers on climate issues and the bulletin to reach the farthest locations.	National Army	The army is the institution that reaches the farthest places.		Cristian Arley Pisso Ossa, Risk and Disaster Management Advisory Office of the department of Cauca
2018	The 42 coordinators of Risk Management from the municipality of Cauca are trained in climate variability to strengthen the dissemination of the information from the bulletins in the communities though the chairs of the risk boards.	Risk Department of Cauca			Cristian Arley Pisso Ossa, Risk and Disaster Management Advisory Office of the department of Cauca
2018	The bulletin is critical for the Risk Office of the department of Cauca, since we design risk strategies, and plans for water management, based on its information.	Risk Department of Cauca	In the department of Cauca, there are approximately 779,000 hectares that are susceptible to inadequate land use, soil removal, and floods.		Cristian Arley Pisso Ossa, Risk and Disaster Management Advisory Office of the department of Cauca
2018	Many other things beyond the MTAs are shared among entities and individuals participating	MTAs stakeholders from Córdoba	A network has been created in Córdoba.	The MTAs has created a trustworthy space that operates regularly.	Alejandro Arames, FENALCE, Córdoba
2017	The bulletin is disseminated by local media (radio and television); with the same organizations we have a	Municipality of Danlí, El Paraíso			Carlos Sarmiento, Technical Assistant from MiAmbiente in the

	lot of dissemination by electronic media.				municipality of El Paraíso, Honduras
2017	I receive the agroclimatic information via the WhatsApp group of the MTAs from San Marcos, Sucre. I share it with my community forwarding the WA message to another WA group. This provides us guidance on when to sow or if we should store feed for livestock in case the rainy season is approaching.	Producer and member of the Board at			
2017	The MTAs warns us if there will be feed shortage and brings recommendations for livestock producers on how to rotate paddocks, plant corn or cutting pasture, so there is enough feed for all animals. We can read this in the bulletins I share with 50 producers every month.	Secretariat for Development and the Environment, Mayor's Office, San Marcos	The data and the information generated by the MTAs are distributed among technicians and they modify production practices to reduce the risk.	A bulletin is drafted, and it reaches stakeholders and entities that forward it.	César Patermina Erazo, Sec. for Dev. and the Environment, Mayor's Office, San Marcos
2017	I warn people on the possibility of the occurrence of strong winds before sowing and they make decisions on the use of more resistant seeds or perhaps not sowing.	FENALCE and FAO	From the producer's personal point of view, they have a tool (the MTAs) to make technical decisions.	The MTAs generates technical information that reaches producer families through participating entities.	Alejandro Arames, FENALCE, Córdoba and Alejandro Polo Montes, FAO, Córdoba
2016	The bulletin is widely used by farmers; it has a good distribution. They ask for it and they understand	FEDEARROZ	The information and data generated by the Committee is	The MTAs produces bulletins every time it meets.	Evaristo González, Technical Assistant in maize, cotton, fruit trees, and vegetables, Montería

	the language, because it has been adapted to what they need.		disseminated and it has a wider distribution.		Mayra Medellín Fernández, Technical Assistant in rice, Montería
2016	We are well informed and oriented. I receive the bulletin via WhatsApp, I read it and I share it, but in addition, the meteorologist always solves our doubts on whatever we need.	Technical Advisor and producer	There is permanent information and response to queries.	The MTAs distributes information through the bulletin and has two meteorologists.	Pedro Benito Oyola Cotera, Technical Assistance and Rice Production, San Marcos

Transformation Area 3: Democratization of Knowledge.

When?	What?	Who makes the change?	Importance	Contribution of the MTAS	Source
2019	Committee meetings were held in Popayán and soon they started rotating across the territory of Cauca, and streaming sessions from anywhere were incorporated.	Secretariat for Agriculture	The MTA is decentralized so different stakeholders can take part in each meeting and we use a streaming service to keep connection with other territories.	The MTA is flexible enough to move and incorporate technologies for inclusion.	Juan Diego Otero, Soil Department of the Secretariat for Agriculture and Rural Development
2019	My 18-year-old daughter attends the meeting with me. She is studying Environmental Engineering, so she explains to us what she is learning, and we apply it on out plot.	Producer families	New generations are joining in agroclimatic sessions and they bring new knowledge to the territories.	It allows for the participation of all people, which facilitates cross-generational exchange.	Rafa Martínez Marcado, farmer and member of the Board at FENALCE, San Marcos

2019	I am using *Windy* on the phone to have prior knowledge of how the wind situation will look like and decide what to do.	Producer families	Technological tools are made accessible to producer families.	The Committee holds technical trainings for all people taking part at the MTAs.	Rafa Martínez Marcado, farmer and member of the Board at FENALCE, San Marcos
2019	I have learned what climate change is, about meteorology in the department, and the difference between weather and climate. Also, about historical data and the possibility of prevention based on them. Becoming acquainted with more people from this area and outside Boyacá, as well as the worldwide connection is very important; knowledge exchange is very important.	Producer families			Robert Álvarez, PICSA promoter and farmer, Boyacá
2019	INTA, UNAM, and other universities make presentations of technologies and we, the producer families, present our experience.	Participants in the Somotillo MTA			Natalia Centeno Rivera and Juan Carlos López, Development Cooperative Federation (FECODESA) technical team, Somotillo
2019	Based on the MTAs, we have decided to create the Women and Climate Change Platform in San Marcos, as a second level organization, which gathers 20–25 associations.	ASOFASAN			Marina González, producer and legal representative of the Agricultural Families and Fish Farmer Association from La Mancha. Beré del Torno (ASOFASAN), San Marcos, Colombia

2019	The Committee has contributed to strengthening the Women Association, because we meet to analyze the MTAs information and we engage our sons and daughters in changing production practices.	ASOFASAN	Marina González, producer and legal representative of the Agricultural Families and Fish Farmer Association from La Mancha. Beré del Torno (ASOFASAN), San Marcos, Colombia
2019	I learned that the biological indicators are still valid, and we must take them into consideration.	Producer	Marina González, producer and legal representative of the Agricultural Families and Fish Farmer Association from La Mancha. Beré del Torno (ASOFASAN), San Marcos, Colombia
2019	We have been able to integrate 15 enthusiastic women to the Committee. Before this year, there were no women.	ASOFASAN and Women Associations from Sucre	Marina González, producer and legal representative of the Agricultural Families and Fish Farmer Association from La Mancha. Beré del Torno (ASOFASAN), San Marcos, Colombia
2019	People are talking about climate change focusing on rainfall, they listen to the forecasts, speak about rain; in general, producers were not concerned about weather forecasts; now communities often talk about them, because they have been quite accurate.	Producer families	Natalia Centeno Rivera and Juan Carlos López, Development Cooperative Federation (FECODESA) technical team, Somotillo

2019	We all understand more about climate variability; we are more active at the MTAs, asking, understanding, and practicing more.	Participants in the San Marcos MTA	Agroclimatic knowledge is enhanced in the territories and knowledge is applied, which reduces risk.	The Committee holds technical trainings for all people taking part at the MTAs.	Orlando García Mendoza, Environmental Management Area, Corpomojana, San Marcos
2019	People participating in the MTAs take ownership of the concepts and speak clearly about weather, climate, climate variability, crop models, and they take this knowledge to the territories.	Participants in the San Marcos MTA			Leonardo Becerra, Rural Director of Integrated Rural Development at the Governorship of the department of Boyacá
2018	We have a bulletin born out of the interaction, knowledge exchange, and consensus among technicians, NGOs, and producers, which facilitates the understanding of farmers with cultural pertinence.	Participants in the MTAs			Martín Leal, Coordinator of the Climate Change Unit at MAGA, Guatemala
2018	We build a dialog with production sectors, which had not happened before. The public-private dialogue is maintained as well as ancient knowledge-technical knowledge.	MARN Guatemala			David Estuardo Barrera, Advisor at the Climate Change Directorate, MARN, Guatemala
2018	At the MTAs, we share knowledge and the studies we conduct; it is a way of socializing them, so they do	MARN Guatemala			David Estuardo Barrera, Advisor at the Climate Change Directorate, MARN, Guatemala

	not stay just within the institution.				
2018	Ancestral knowledge is included in the bulletins of the Cauca MTA. As an instance, the corresponding moon and agricultural calendars.	Secretariat for Agriculture	Mainstreaming of different knowledge into climate risk management and recommendations to mitigate it.	The MTA is an open space for knowledge exchange.	Juan Diego Otero, Soil Department of the Secretariat for Agriculture and Rural Development
2018	We send agroclimatic information via WhatsApp and we receive recommendations from producers through the same channel; we analyze them to include them in the bulletin. We receive about 60 recommendations a month.	Secretariat for Agriculture of Cauca	Female and male producers participate in drafting the recommendations using digital means.	The MTAs has specialists who receive and analyze the recommendations from the field.	Juan Diego Otero, Soil Department of the Secretariat for Agriculture and Rural Development
2018	The Committee clears my doubts; I have learned, for instance, why forecasts are not accurate or why rains may turn into hurricanes.	ICA	The technicians working in the territories acquire new knowledge on agroclimatic issues.	The MTAs provides high-level technical trainings.	Fabian Enrique Rodríguez Jiménez, Rice Advisor at ICA, San Marcos
2018	I have received an intensive training on agroclimatic, meteorological, and climate issues previously unknown, climate variability	Members of the MTAs	Most of us are agricultural engineers and we did not know about those issues.	The visits from climate experts and meteorologist have been regular and they have trained us: financial support from FEDEARROZ	Luis Lastra, Sura Seguros Tolima

2018	We as technicians feel more confident and more knowledgeable to provide support to the producer families we serve on the field.	ICA Technicians	Producer families are better advised by field technicians.	The MTAs develops technical training processes of high quality.	Fabian Enrique Rodríguez Jiménez, Rice Advisor at ICA, San Marcos
2018	The MTAs provides training on tools and reports results of projects such as the WFP sentinel sites.	Participants in the Chiquimula MTA			Freddy Díaz, CUNORI, Chiquimula, Guatemala.
2018	The person who presented the diagnostic studies has educational skills to do so, he uses appropriate resources and language for us to address issues difficult to understand, and he goes back as many times as needed to explain everything that is necessary.	FENALCE	It provides evidence of the conditions of the learning process on climate issues for all sectors.	Suitable experts are hired to develop the MTAs methodology (FEDEARROZ in this case)	Mauricio Yepes, FENALCE, Tolima
2018	All crops in the area participate at the MTAs: cotton, rice, cereals, livestock, fruit trees, etc.	Trade unions and associations from Córdoba	All production sectors attach importance to climate variability for decision making.	The MTAs has created a trustworthy space that operates regularly.	Alejandro Arames, FENALCE, Córdoba and Alejandro Polo Montes, FAO, Córdoba
2017	The MTAs moves from being a case study in a department to be a strategy in the whole municipality.	Secretariat for Agriculture			Juan Diego Otero, Soil Department of the Secretariat for Agriculture and Rural Development, Cauca
2017	The MTAs trained me to install, read, and manage the information from the stations. I, in turn, trained producers.	ARSAGRO			Rodolfo Rodríguez, Field Technician, Regional Association for Agricultural Services, ARSAGRO, Honduras

2017	I have learned a lot; I am an agronomist, but before, when I heard about the agroclimatic factor, I was not so clear on that concept. Now I understand about evapotranspiration, relative humidity, and other concepts.	Technician from ARSAGRO			Rodolfo Rodríguez, Field Technician, Regional Association for Agricultural Services, ARSAGRO, Honduras
2017	Meteorologists listen to farmers and include bioindicators in the analyses conducted by the committee. We have interacted with indicators of both experts and farmers.	Meteorologists	All people are included in drafting recommendations.	The MTA is a space for inclusive exchange where all knowledge takes part.	Álvaro José Alvarado Madrid, rice producer, San Marcos
2017	At the beginning, the bulletin included recommendations for rice and maize, but now all the traditional crops of the area are included, as well as the livestock sector.	FEDEARROZ	Other production sectors have been included in the recommendations to reduce climate variability risks in the area.	The MTA is an inclusive and permanent space for all production sectors.	Evaristo González, Technical Assistant in maize, cotton, fruit trees, and vegetables, Montería and Mayra Medellín Fernández, Technical Assistant in rice, Montería
2017	With CIAT, we have learned to use mobile applications for crop modeling and planning.	Technicians	Technological tools are incorporated to reduce climate variability risks.	The MTA is a space for high-level training.	Evaristo González, Technical Assistant in maize, cotton, fruit trees, and vegetables, Montería Mayra Medellín Fernández, Technical Assistant in rice, Montería
2017	Thanks to the benefits I obtain at the MTAs, I grow professionally, and I am able	Secretariat for Development and the Environment,	There is growth of technicians serving the agricultural sector in the	The MTAs develops technical capacities related	César Patermina Erazo, Sec. for Dev. and the Environment, Mayor's Office, San Marcos

	to provide better support to small producers.	Mayor's Office, San Marcos	territories based on agroclimatic knowledge.	to agroclimatic issues.	
2017	The technicians have not gained better skills to make recommendations based on climate information.	Local technicians	Technical Assistance in the area is strengthened.	The Committee has given us the possibility to better expand information and take it to the producer	Evaristo González, Technical Assistant in maize, cotton, fruit trees, and vegetables, Montería Mayra Medellín Fernández, Technical Assistant in rice, Montería
2017	Now I can say that I know about climate variability and prediction, and I am able to explain the occurrence of El Niño and La Niña events.	Secretariat for Development and the Environment, Mayor's Office, San Marcos	There is growth of technicians serving the agricultural sector in the territories based on agroclimatic knowledge.	The MTAs develops technical capacities related to agroclimatic issues.	César Patermina Erazo, Sec. for Dev. and the Environment, Mayor's Office, San Marcos
2017	Climate tests were performed on maize to evaluate the differences between one year and the other and the outcomes were presented at the MTAs.	FENALCE	Seeds and crops are tested to be adapted to the climate variability in the area.	The MTAs incorporates climate variability and encourages conducting experiments; then they are shared at the Committee.	Evaristo González, Technical Assistant in maize, cotton, fruit trees, and vegetables, Montería Mayra Medellín Fernández, Technical Assistant in rice, Montería
2017	MTAs participants explain a new member of the bean sector why climate prediction is not always accurate, as he	MTAs participants	There is evidence of the training received.	The MTAs, with support from FEDEARROZ, incorporates a	Luis Lastra, Sura Seguros Tolima

	had complained that La Niña event was not as strong as predicted and this affected the production of smallholders.			meteorologist to train members.	
2017	In my household, the Committee helped us gaining new knowledge and to build a relationship with officials and lecturers that we could not get to know otherwise.	Producer families	Relationships are built that otherwise would not exist.	The MTA is a space to build relationships.	Rafa Martínez Marcado, farmer and member of the Board at FENALCE, San Marcos
2017	As technicians, we must gear up and offer a better product, because people are more knowledgeable, they know all climate information from their communities.	CENAOS-COPECO, Honduras			CENAOS-COPECO, Honduras
2017	The producer becomes acquainted with more and newer technologies that allow better production with reduced risk.	Rice producer and his son	Producer families have an increased profitability from their land as a result of the training received.	The MTAs provide training in new production technologies to address climate variability.	Melciades Alejandro Machado Fernández, Producer, San Marcos.
2017	We wrote an article about the impact on the sowing date, according to climate variability in Córdoba, thanks to the knowledge acquired at the MTAs.	Field technicians	Field technicians, agronomists, and environmentalists have acquired and taken ownership of the knowledge provided at the Committee, which they apply at their workplace.	The MTAs develops high-level capacities in participants.	Evaristo González, Technical Assistant in maize, cotton, fruit trees, and vegetables, Montería Mayra Medellín Fernández, Technical Assistant in rice, Montería

2017	Producers know the terms and the local indicators; thus, they make a better use of the climate information for their production systems. The farmer is now interested in the products we generate.	CENAOS-COPECO, Honduras			CENAOS-COPECO, Honduras
2014	Professionals from the environmental and agricultural area acquire knowledge about climate that we did not have before.	Professionals from the environmental and agricultural area in Córdoba.	Technicians working in the territories receive new training.	High-level training on agroclimatic issues and adaptation to climate variability is promoted.	Alejandro Arames, FENALCE, Córdoba Alejandro Polo Montes, FAO, Córdoba
2014	High-level training is provided to participants in the Committee. For example, on bioindicators, modeling, and rice hybrids, among others.	MTAs participants from Córdoba	The MTA is a space for local training of very high quality.	High-level training on agroclimatic issues and adaptation to climate variability is promoted.	Alejandro Arames, FENALCE, Córdoba Alejandro Polo Montes, FAO, Córdoba

Transformation Area 4: Transformation of Production Practices.

When?	What?	Who makes the change?	Importance	Contribution of the MTAS	Source
2019	We establish our sowing calendars based on the climate forecast reported by the Committee.	FENALCE	Trade unions have transformed production practices to adapt to climate variability using the results from the MTAs.	The MTAs reports increasingly accurate forecasts at the local level.	Mauricio Yepes, FENALCE, Tolima
2019	I switched to rice, because it gets along very well with water; it's in very good condition there.	Producer families	Change in practices to adjust them to the conditions in the territories, reducing production losses.	Recommendations are made incorporating different perspectives, which benefits the families.	Rafa Martínez Marcado, farmer and member of the Board at FENALCE, San Marcos
2019	ICA, Agrosavia, and FENALCE agree on sowing date arrangements at the time of a pest outbreak, based on the rainfall forecasts generated by the MTAs. The resolution reads "according to the rainfall forecast reported by the Tolima MTA. This will save the year."	FENALCE and producer families	Decisions are being made, which benefit producer families, based on MTAs results.	Accurate forecasts are produced, and they are increasingly accepted by institutions.	Mauricio Yepes, FENALCE, Tolima
2019	Now in December, farmers plant potatoes, maize, and peas. We started identifying grains that require less water; we have to see when it is going to rain, and we use the MTAS report for that.	Producer families			Robert Álvarez, PICSA promoter and farmer, Boyacá

2019	Sowing dates have been modified. Previously they were set based on tradition; now they depend on the information provided at the MTAs.	FENALCE	Losses to the climate impact are reduced.	The MTAs makes projections, forecasts, and recommendations that are useful to reduce the risk of climate variability.	Evaristo González, Technical Assistant in maize, cotton, fruit trees, and vegetables, Montería and Mayra Medellín Fernández, Technical Assistant in rice, Montería
2019	We are deciding which seed to sow (early, late, etc.) accordingly to climate conditions. The information from the Committee helps us making decisions about what the next step is in our crops, so there are no great losses.	FECODESA			Natalia Centeno Rivera and Juan Carlos López, Development Cooperative Federation (FECODESA) technical team, Somotillo
2019	Production practices are not good in the Somotillo and Villa Nueva areas. Organic production is considered excessively laborious and there are no incentives. The one thing that is motivating a culture shift is to be more resilient to climate change, which is introduced by the Committee.	Producer families			Natalia Centeno Rivera and Juan Carlos López, Development Cooperative Federation (FECODESA) technical team, Somotillo
2019	10% of the producers of Villa Nueva and Somotillo are changing their practices causing a demonstration effect; the rest are interested.	Producer families			Natalia Centeno Rivera and Juan Carlos López, Development Cooperative Federation (FECODESA) technical team, Somotillo
2019	A yellow aphid is the greatest threat to the crops in the area. In an exchange in Honduras, we learned how to control it and we reported it at the	FECODESA			Natalia Centeno Rivera and Juan Carlos López, Development Cooperative Federation (FECODESA) technical team, Somotillo

	MTAs. We have reduced this pest in the area.				
2019	We do not sow in April, but in June. In my case, this led to profits, and I did it, because the MTAs recommended so. Those who did not follow the MTAS recommendations lost around 3 million pesos per hectare, while I gained 60 per hectare.	Producer and member of the Board in San Marcos			Mariana, producer, San Marcos
2019	Thanks to the Committee we use much less Glyphosate.	Producer families	The use of fertilizers, agrochemicals, and herbicides is reduced.	The MTAs develops knowledge to reduce the environmental impact.	Álvaro José Alvarado Madrid, rice producer, San Marcos
2019	Forecasts are useful for decision making. Fruit producers have reservoirs with harvested rainwater; for them it is important to know whether it is going to rain. They consult the bulletin to know whether it will rain; if they see it will, they clean a 15 m x 15 m reservoir, which increased its level yesterday, because they had run out of water.	Producer families in Chiquimula			Leonidas Chacón, Coordinator of the Environmental Management Unit in the municipality of Chiquimula

2019	We rotate maize the first semester with rice on the second, leaving a 100% profit, besides, we changed agrochemicals and weed presence is decreasing.	Producer families	Climate variability impacts on producer families are reduced with the MTAs recommendations.	MTAs make recommendations adapted to the conditions in the territories, which are agreed among stakeholders with different experiences.	Rafa Martínez Marcado, farmer and member of the Board at FENALCE, San Marcos
2019	I have modified the date to request a loan for my production and it has allowed me not to lose money.	Producer families	There is an impact on the reduction of economic loss, both by changes in production practices and in financial practices of producer families.	MTAs make recommendations on production practices based on the agroclimatic information that influence producer families and institutions.	Rafa Martínez Marcado, farmer and member of the Board at FENALCE, San Marcos
2018	At the community level, vegetable production has been modified using MTAs forecasts. We know we are not getting a rainy season as they were before, so we have to sow more, because cycles are shorter. This means changing our whole culture to be able to respond to climate.	Producer families			Leonidas Chacón, Coordinator of the Environmental Management Unit. Municipality of Chiquimula

2018	In my municipality, I use the MTAs forecasts for the community rainwater harvesting project. We have two 450,000-L reservoirs, which are below the mid-point and we are waiting for the forecasts to make decisions, because the season is supposed to end in October and that is not enough for the dry season.	Municipality of Chiquimula			Leonidas Chacón, Coordinator of the Environmental Management Unit, municipality of Chiquimula
2018	Half the producer families associated to the Association of Producers of the East have changed some practices under the recommendation of the Danlí MTA.	APAO			Kenia Ávila, producer and member of the Board at the Association of Producers of the East, El Paraíso, Honduras
2018	We rented land in Guatemala because the Committee taught us that there is less rainfall there and thus, we did not lose.	Producer families	Climate variability impacts on producer families are reduced with the MTAs recommendations.	MTAs make recommendations adapted to the conditions in the territories, which are agreed among stakeholders with different experiences.	Rafa Martínez Marcado, farmer and member of the Board at FENALCE, San Marcos
2018	Sowing dates for rice and maize were proposed, and the producer families who complied (20 to 30% of all the families) were much less affected by loss.	Usocoello	Losses are reduced due to changes in the patters prepared based on the information generated by the MTAs.	Recommendations are adjusted to the products and climate conditions of each area.	Tomás Rojas Céspedes, Usocoello, Tolima

2018	We know how to consult the level of rivers to make decisions with early warnings.	FAO and FENALCE	Learning technical tools to get early warnings contribute to make timely decisions.	The MTAs provides training on tools to prevent and generate early warnings.	Alejandro Arames, FENALCE, Córdoba and Alejandro Polo Montes, FAO, Córdoba
2018	There has been a change in the mentality of producers; now they consult about climate variability and recommendations for their crops, and they base their decisions on information from the MTAs.	ICA Technicians	An informed decision making, and production practices are based on climate information.	The MTAs generates climate information and recommendations understandable by producers.	Fabian Enrique Rodríguez Jiménez, Rice Advisor at ICA, San Marcos
2018	In San Marcos, they used to sow without prevention in April-May; this has changed to the point in which sowing is performed in June since environmental supply is better. Before the MTAs, this was not known.	Rice-producing families	Long-standing agricultural practices are changed to adapt to climate variability.	Technical knowledge and recommendations are shared to adjust agricultural practices to climate variability and thus reduce risk.	Pedro Benito Oyola Cotera, technical assistance, San Marcos
2018	Rice, watermelon and maize producers sow at different dates, because they wait for the forecast of the Committees to decide the date.	Maize-producing families from San Marcos	Losses are reduced due to changes in an agricultural practice, using variable sowing dates, depending on climate variability.	The MTAs makes forecasts and recommends sowing dates for maize, watermelon, and rice.	Orlando García Mendoza, Environmental Management Area, Corpomojana
2017	My production has improved an 80%. My profitability has increased since I modified the way I used to sow. Formerly, I sowed the entire farm. Now, I sow the lower land, as it floods	Rice producer	Profitability is increased as a result of agricultural practices adjusted to climate variability.	The MTAs builds recommendations and disseminates them among producers.	Álvaro José Alvarado Madrid, rice producer, San Marcos

	earlier, and then the higher land.				
2017	ARSAGRO producers know about agroclimatic issues and look forward to the MTAs bulletin we distribute to make decisions about sowing. The MTAs has allowed solving many problems and the producers feel supported.	ARSAGRO			Rodolfo Rodríguez, Field Technician, Regional Association for Agricultural Services, ARSAGRO, Honduras
2017	In my field, I have performed *caballoneo* (efficient water management technique) to retain rainwater, thus my field will retain more moisture and avoid runoff. I have an improvement of 500 kilos per hectare, which are about 8 to 10 bundles. It is noticeable	Rice producer	Profitability is increased as a result of agricultural practices adjusted to climate variability.	The MTAs builds recommendations and disseminates them among producers.	Pedro Benito Oyola Cotera, Technical Advisor and rice producer, San Marcos
2017	We used new rice varieties, such as Feearroz2000, which adapt to the climate in the area and we have learned to sow it during the best moths	Rice producers	Seed varieties adapted to the area are developed, as they show better productivity for farmers.	The MTAs report studies on different rice varieties suitable for the climate variability in the area.	Álvaro José Alvarado Madrid, rice producer, San Marcos
2017	At the company, we changed the time to start plant nurseries. It used to be on January, now we do it on February or March, depending on what the MTAs recommends.	Corpomojana	Changes in an agricultural practice, using variable sowing dates to adapt to climate variability.	The MTAs provides climate forecasts for the territory and makes recommendations.	Orlando García Mendoza, Environmental Management Area, Corpomojana

2017	Three producers who change their sowing date produce 3 tons more and have a demonstration effect over the others, who change their sowing dates the next year, according to the recommendation of the Committee.	Producer families	The demonstration effect is one of the most important strategies in the areas where Committees are held.	The MTAs generates data and information that reaches producer families for their decision-making process.	Evaristo González, Technical Assistant in maize, cotton, fruit trees, and vegetables, Montería Mayra Medellín Fernández, Technical Assistant in rice, Montería
2017	I had an increase of one tone per hectare in my production and an increased profitability by changing the sowing date and reducing the use of insecticides, fertilizers, and pesticides.	Rice producer and his son	Producers increase their profitability applying the MTAs recommendations.	The MTAs makes recommendations that are useful to address climate variability.	Melciades Alejandro Machado Fernández, Producer, San Marcos.

Transformation Area 5: Political Advocacy and Institutional Transformation.

When?	**What?**	**Who makes the change?**	**Importance**	**Contribution of the MTAS**	**Source**
2019	Municipal Risk Management Plans are updated with an agricultural component incorporated upon the basis of the MTAs.	Secretariat for Agriculture and Management Advisory at the department of Cauca	Climate variability is incorporated in other areas.		Cristian Arley Pisso Ossa, Risk and Disaster Management Advisory Office of the department of Cauca
2019	UNDP is deciding with the Committee to create a single bulletin about climate variability, instead of duplicating bulletins	UNDP	There is a clear recognition of the importance of the bulletin for the region of San Marcos	The Committee creates a bulletin that is disseminated across the territory	César Patermina Erazo, Mayor's Office, San Marcos

				and is useful for decision making.	
2019	A professional is hired to join the Risk Advisory Office of Cauca, who is directly oriented towards the agricultural sector, monitoring and making recommendations on climate variability and articulating the inclusion of risk management into the MTAs.		Incorporation of risk management expertise into the Cauca MTA.	The MTA is a space that brings together stakeholders with different knowledge, encouraging the exchange and collective construction of knowledge.	Cristian Arley Pisso Ossa, Risk and Disaster Management Advisory Office of the department of Cauca
2019	One of the responsibilities I was assigned three months ago, when I joined FENALCE as a technician, was to participate actively in the MTAs activities.	FENALCE	MTAs has been mainstreamed into the key activities of technicians from trade union organizations.	A participation space is created for all production sectors.	Mauricio Yepes, FENALCE, Tolima
2019	The PICSA project is being supported by the MTAs and in turn the MTAs is being supported by the PICSA project.	PICSA Project			Robert Álvarez, PICSA promoter and farmer, Boyacá
2019	Climate Change Units from the Ministry of Agriculture are becoming known in the territories, thanks to the MTAs.	Climate Change Unit, MAGA, Guatemala			Martín Leal, Coordinator of the Climate Change Unit at MAGA, Guatemala
2019	The first national agroclimatic bulletin related to the MTAs is presented in Guatemala.	INSIMUVEH			Juan Pablo Otero, Director of INSIVUMEH

2019	We started working on resilience insurances with a parameter-based agricultural insurance for any crop, for medium-sized and large producers, drawing from the work of MTAs in Guatemala.	MAGA Guatemala			Martín Leal, Coordinator of the Climate Change Unit at MAGA, Guatemala
2019	The MTA is a space to create joint strategies among organizations, to complement and become acquainted with each other.	Participants in the Somotillo MTA			Natalia Centeno Rivera and Juan Carlos López, Development Cooperative Federation (FECODESA) technical team, Somotillo
2019	A section about SAN is integrated into the Chiquimula MTA bulletin.	Action against Hunger			Luis Melgar and Fernando Portillo, Action against Hunger, Guatemala
2019	The MTA is frequently asked about climate impact; for example, a local government requires a study about "Climate Change and Migration."	CUNORI			Freddy Díaz, CUNORI, Chiquimula, Guatemala.
2019	The Risk Council of the department of Chiquimula identifies the MTA its climate advisor.	Departmental government			Freddy Díaz, CUNORI, Chiquimula, Guatemala.
2019	From Action against Hunger, we provide the information generated at the sentinel sites, and now at the seasonal sites, so it can be discussed at the MTAs	Action against Hunger			Luis Melgar and Fernando Portillo, Action against Hunger, Guatemala
2019	The Tolima MTA takes place in the facilities of Sura Seguros.	Sura Seguros	This is the first insurance company to invite an MTAs to its	The MTA is a space where representatives of	Luis Lastra, Sura Seguros Tolima

			facilities, recognizing the importance of climate variability.	insurance companies may participate; it is under the leadership of Eng. Lastra.	
2018	Formerly, we did not have agroclimatic information. Now, participating at the MTAs, we disseminate the bulletins, from management all the way to technicians, and report the outcomes at our monthly workshops.	Action against Hunger			Luis Melgar, Action against Hunger, Fernando Portillo
2018	INSIVUMEH's support to the MTAs is materialized and it is defined as a strategic project. Technicians are sent to MTAs meetings.	INSIVUMEH			Juan Pablo Oliva, Director of INSIVUMEH
2018	Risk issues are included in the risk management posters, which currently reach over 13,000 producers, due to climate variability and strategies to face it are using the information and data from the Cauca MTA.	Risk Management Office of the department of Cauca	Before, we did not know how to face climate variability, nor what to recommend farmers.	The MTAs makes recommendations that are included in the bulletins for producer families.	Cristian Arley Pisso Ossa, Risk and Disaster Management Advisory Office of the department of Cauca
2018	The Governorship has a space for dialogue about climate and agriculture, farmers' agricultural practices, sector policies, exchange with citizens and institutions, the dissemination of tools, and contact with other	Governorship of Boyacá			Leonardo Becerra, Rural Director of Integrated Rural Development at the Governorship of the department of Boyacá

	experiences from other parts of the country.				
2018	Crop insurances are adjusted according to the climate projection data shared on the Tolima MTA.	Sura Seguros	It provides an example of how a private insurance company can refine its insurance programs based on climate variability.	It reports local climate projections that allow for more accurate predictions of crop risks to generate more accurate agricultural insurance products.	Luis Lastra, Sura Seguros Tolima
2018	Diagnostics are no longer made upon the basis of general statistics but using the MTA database.	Sura Seguros	The data shared at the Committee are used by the insurance company.	More accurate local climate data are produced, which are also adjusted to site conditions and the agricultural products of the place.	Luis Lastra, Sura Seguros Tolima
2018	The way in which farmers are served has changed, because the recommendations are based on MTAs results, e.g., the variability of sowing dates.	ICA	Technical assistance is adjusted to the climate variability of every area.	MTAs makes predictions, forecasts, and recommendations for each area in particular.	Fabian Enrique Rodríguez Jiménez, Rice Advisor at ICA, San Marcos

2018	The municipality makes recommendations for producers based on the data shared at the MTAs; e.g., if there will be water shortage or, on the contrary, excessive rainfall.	Municipality of San Marcos	The data generated by the MTAs are helpful and used in programs across the municipality.	The information and data generated by the MTAs are relevant and useful for the territories.	César Patermina Erazo, Mayor's Office, San Marcos
2018	The knowledge acquired is multiplied when you participate in the Board, Management, Committees, meetings with technicians, and Assemblies.	Usocoello	The ways in which MTAs information and recommendations are disseminated have multiplied.	The information produced is in the interest of local entities.	Tomás Rojas Céspedes, Usocoello, Tolima
2018	There is an established base group that keeps the MTAs operational.	MTAs stakeholders, mainly FEDEARROZ, U of Tolima, Asiatol, Cortolima	The MTAs operates regularly.	A regular mode of operation highly led by FEDEARROZ-U of Tolima has been established.	Luis Lastra, Sura Seguros Tolima
2018	When I called IDEAM to ask for a forecast, because we were really worried about the water situation, they recommended attending the Committee meetings.	Usocoello and IDEAM	IDEAM identifies MTAs as the local bodies for issues related to climate at the local level.	The recognition of MTAs as institutions has been achieved.	Tomás Rojas Céspedes, Usocoello, Tolima
2018	We adopt preventive measures before an El Niño event, based on the information provided at the MTAs.	Usocoello	Debate and knowledge allow local stakeholders to be mindful of climate evolution.	A participation space is created for multiple local stakeholders.	Tomás Rojas Céspedes, Usocoello, Tolima

2018	There are some programs that are adjusted upon the information that is being generated by the Committees; e.g., clearing activities that require clean canals; nowadays cleaning is scheduled according to the information generated by the Committees.	Usocoello	Different agricultural practices are being adjusted to the climate variability in the areas.	Recommendations are adjusted to the products and climate conditions of each area.	Tomás Rojas Céspedes, Usocoello, Tolima
2018	The MTAs has opened to us the possibility of exchanging and developing international contacts with other institutions, connecting with projects, and communicating with departmental offices.	MAGA, Guatemala			Martín Leal, Coordinator of the Climate Change Unit at MAGA, Guatemala
2018	The MTAs has articulated the institutions in the territory to allow for climate mitigation and adaptation.	Participants in the San Marcos MTA	The coordination among entities of the agricultural sector favors a sounder territorial strategy to react upon climate variability.	The San Marcos MTA has operated on a regular basis and it has been positioned as a specialized meeting space that is relevant for decision making.	César Patermina Erazo, Sec. for Dev. and the Environment, Mayor's Office, San Marcos Orlando García Mendoza, Environmental Management Area, Corpomojana
2018	Thesis students from CUNORI conduct research for the MTAs.	CUNORI			Freddy Díaz, CUNORI, Chiquimula, Guatemala.
2018	The Chiquimula MTA has turned into a climate school.	Participants in the Chiquimula MTA			Freddy Díaz, CUNORI, Chiquimula, Guatemala.

2018	The Cauca MTA is expanded to include more stakeholders, a wider coverage, and more production sectors.	Secretariat for Agriculture of the department of Cauca.	The first Committee meeting focused on a territory and a more specific population, related to a specific project.		Juan Diego Otero, Soil Department of the Secretariat for Agriculture and Rural Development, Cauca
2018	The bulletins are used by the disaster management department of the municipality of San Marcos to communicate possible failures in the hydroelectric power plant.	Risk Department of the Mayor's Office	There is a means to communicate climate risk, which is being used by different stakeholders in the region of San Marcos.	The MTAs produces and distributes the bulletin, which is reaching an important share of the population.	César Patermina Erazo, Mayor's Office, San Marcos
2018	It strengthens the relationship between agricultural insurance products and the risks of climate variability over agricultural and forestry activities.	Sura Seguros	There are little agricultural insurance products to tackle climate variability in the agricultural sector.	The Tolima MTA opens a space for exchange with the Sura Seguros initiative focused on the protection of the assets of agricultural and forestry producers and the relationship between insurance with climate variability is analyzed.	Luis Lastra, Sura Seguros Tolima
2018	INSIVUMEH joins the Chiquimula MTA and starts working with the MTAs methodology.	Chiquimula MTA			Freddy Díaz, CUNORI, Chiquimula, Guatemala.

2018	The MTAs becomes the strategy to address the impacts over the most vulnerable areas identified by the AgroCauca Project.	Secretariat for Agriculture of Cauca			Juan Diego Otero, Soil Department of the Secretariat for Agriculture and Rural Development
2017	The insurance company changed the dates of insurances based on the information generated at the MTAs.	Insurance company	Insurances are adjusted to the climate variability of every area.	The Committee gains credibility among entities associated to the agricultural sector.	Alejandro Arames, FENALCE, Córdoba and Alejandro Polo Montes, FAO, Córdoba
2017	The Committee enables us to guide the producer in terms of sowing dates, what crop, and what variety, according to the forecast and the bulletins.	ARSAGRO			Rodolfo Rodríguez, Field Technician, Regional Association for Agricultural Services, ARSAGRO, Honduras
2017	Because of the careers it offers, CUNORI has been interested in climate and the MTAs allows building a connection between those careers and the development of the municipality. It is a relationship that favors both.	CUNORI			Freddy Díaz, CUNORI, Chiquimula, Guatemala.
2017	The MTAs allows adding predictions and mitigation recommendations to the Meteorological Information Committee we had started in Chiquimula in 2015.	Meteorological Information Committee, Chiquimula, Guatemala			Freddy Díaz, CUNORI, Chiquimula, Guatemala.
2017	Resources of the AgroCauca Project are made available to the				Juan Diego Otero, Soil Department of the

	Cauca MTA; e.g., the agronomist or the data modeler.				Secretariat for Agriculture and Rural Development
2016	The methodology developed for the institutionalization of the Committees in Honduras is very valuable.				Diego Obando, Resca, Honduras
2016	In Honduras, the MTAs (known as PACs) are incorporated as a State policy under the responsibility of SAG.	(UACC&GR) at SAG			CENAOS-COPECO, Honduras
2016	Crops have changed a lot. At the Committee we were able to link climate variability with plant protection from the very beginning.	FENALCE	Crops and agricultural practices have been modified based on climate variability.	The MTAs has incorporated technical knowledge adjusted to the climate conditions in every area.	Evaristo González, Technical Assistant in maize, cotton, fruit trees, and vegetables, Mayra Medellín Fernández, Technical Assistant in rice, Montería

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