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Info Note

Prioritizing Investment Portfolios for Climate-smart Agriculture (CSA) in Guatemala

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Key Messages

- With the purpose of pulling forward an integrated approach to development through the promotion of Climate-smart Agriculture (CSA), CSA investment Prioritization Framework (CSA-PF) has been implemented as a tool to support a participatory identification, analysis, and prioritization of CSA practices for the Guatemalan Dry Corridor.
- The set of CSA practices selected through multiple analytical and participatory processes, reflects the collective desire of fostering a climate-smart and productive agricultural sector in the country's Dry Corridor.
- From the financial perspective, the analysis pointed out the introduction of pest- and disease-tolerant bean varieties, heat- and drought-tolerant maize varieties, and crop rotation as the most profitable options for producers within the region.
- The results from the cost-benefit analysis also favor agroforestry systems with the benefit of reducing water and soil pollution in the medium term, complemented by their high carbon-capture potential, which constitutes an important mitigation option within the agricultural sector.
- The implementation of the CSA-PF in Guatemala offered appropriate investment options to achieve several objectives from political and social stakeholders in the Guatemalan Dry Corridor, i.e., farmers, as well as representatives from the government, academia, research, and donor sectors.
- In addition, the process highlighted the importance of complementing the economic analysis with a participatory discussion of social, cultural, and environmental benefits of such practices to improve decision-making in agriculture. This, inter alia, ensures that practices with significant social benefits or with medium-term economic benefits, but high investment costs, are not excluded from the analysis and the final investment portfolios.

Transforming Climate Challenges in Smart Solutions for Agriculture

The concept of Climate-smart Agriculture (CSA) reflects an integrated approach for sustainable development. It arises from the need to provide innovative solutions towards the complex and integrated goals of sustainable increasing yields (productivity), improving resilience capacity (adaptation), and promoting a low emissions agricultural sector (mitigation) in the face of present and future climate challenges. CSA has also been applied as a conceptual framework to emphasize the environmental, economic, and social benefits of adopting diverse portfolios of agricultural options (practices, technologies, and services), programs, and policies at different levels.

The Dry Corridor in Central America has been affected by recurrent severe droughts in the last two years, which have particularly affected maize and bean production, threatening the food and nutrition security of approximately 2.5 million people in the region. Over 50% of the people affected are subsistence farmers distributed across central, northeastern, and northwestern Guatemala. In these regions, a prolonged drought in 2014 led to crop losses of about 70% of bean harvest (equivalent to 70,000 tons) and 80% in maize (200,000 tons), compared to yields in 2013. Such losses were valued at US$58 million and they have had major consequences on local and regional food reserves, on people's nutrition and health, as well as on access to drinking water. It has been estimated that approximately 275,000 families were affected by the lack of rainfall in the Guatemalan Dry Corridor during year 2014 (UNOCHA, 2014).

These events brought to light the urgent need of short-term strategies that could help the affected families, but also of a medium- and long-term vision to help increasing resilience among producers to unexpected and extreme weather events. This vision would have to incorporate climate variables (such as changes in rainfall patterns) into agricultural planning and other development interventions, as the agricultural sector is one of the major contributors to national economy.

As a consequence of the severe drought in 2014, the Government of Guatemala, through the Ministry of Agriculture, Livestock and Food (MAGA, its Spanish initials) and the Secretariat for Food and Nutritional Security (SESAN, its Spanish initials), drew up a 6-month plan for US$88 million, known as "From the Dry Corridor to the Corridor of Opportunities: Plan to help families affected by the prolonged heatwave of 2014". The plan consists of food assistance (rations) for households committed to adopt soil and water conservation practices aimed at increasing the resilience of agricultural systems to potential climate threats, as well as at the establishment of community markets and long-term investments in conservation strategies. Due to the increasing frequency of drought, this emergency plan was extended through 2015.

In line with these initiatives, the International Center for Tropical Agriculture (CIAT) and the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) have sought to support the decision-making process in Guatemala, through the CSA-PF. The close collaboration with MAGA's Climate Change Unit (UCC, its Spanish initials) has brought to light the relevance of its implementation in the generation of sustainability indicators and criteria that allow for the characterization and assessment of plans and initiatives conducted by the Ministry across the territory. In this way, a reference framework was established for institutional planning when defining, channeling, and implementing investments in key CSA practices that can ensure food security and resilience among farmers considered to be the most vulnerable to climate change and variability.

The project known as "Prioritizing Investments for Climate-smart Agriculture in Guatemala" promoted the application of a participatory process, led by specialists in the environmental, economic, and social cost-benefit analysis of implementing CSA practices in the Dry Corridor.

CSA Prioritization Framework

In Guatemala, the CSA-PF has used a four-phase approach:

Phase I: Preliminary Assessment of CSA Options

Consultations with representatives of MAGA and national agricultural experts were carried out to establish the scope of the CSA prioritization process. The stakeholders involved highlighted key agroecological zones according to their climate vulnerability (the dry corridor, the highlands, and the northern region) and different environmental threats and impacts on agro-ecosystems (droughts, floods, temperature rises, increases in pest and disease incidence, and soil erosion, among others).

The experts also identified 28 CSA practices relevant for these regions and assessed their performance by means of productivity, adaptation, and mitigation indicators (Figure 1).

Pillar	Indicator	Metrics
P	Yield	Δ (kg/ha/year)
	Employment	Δ (hours/ha/year)
	Financial income	Δ (Net Value/ha/year)
	Variability of production	Δ Standard Deviation
A	Resilience	Questions on Resilience
	Efficient use of water	Δ (liters/Kg product)
	Erosion	Δ (Kg/ha/year)
	Financial income of women	Δ (Net Value/ha/year)
	Biodiversity	Questions on Biodiversity
	Access to food	Δ Kcal/person/year Δ % Food expense$/day
	Soil quality	Δ % Organic Carbon Δ % Organic Matter
	Adaptive capacity in women	Questions on Resilience
	Efficient use of fertilizers	Δ(liters/Kg); Δ (Kg/Kg)
M	Intensity of emissions	Δ (CO2eq/kg product/year)
	Land-use change	Δ (CO2 eq/m2/year)

Figure 1. *Indicators used to assess CSA practices. P: Productivity; A: Adaptation; M: Mitigation.*

Phase II: Identification of CSA Options

A workshop was held in August 2014 in Guatemala City, with the attendance of 43 representatives of the national government, producer associations, academia, research institutions, and donors interested in scaling up CSA in Guatemala; they ranked the Dry Corridor as the main area of intervention for the project.

Photo 1. *First CSA-PF Workshop in Guatemala City. Discussion on CSA practices. (J.L Urrea, CCAFS)*

On the basis of an extensive list of practices, eight CSA practices associated with maize and bean production systems were prioritized for a subsequent phase to conduct an economic analysis, based on criteria set by the working group in a plenary session. Among the prioritization criteria, the following stand out:

- Relevance of key production systems for food security in the Guatemalan Dry Corridor.
- Capacity to respond to the current drought risk.
- Accessibility and applicability for smallholders in terms of implementation costs.
- Respect for territorial and cultural aspects.
- Benefits associated to the CSA pillars (productivity, adaptation, and mitigation) (Figure 1).

List of Prioritized CSA Options:

- Stone barriers
- Conservation tillage with mulch
- Integrated pest management: pest- and disease-tolerant bean varieties
- Water reservoirs/ponds + drip irrigation
- Crop rotation (maize–bean)
- Agroforestry systems: Live barriers with hedgerows
- Heat- and water stress-tolerant maize varieties
- Contour ditches

The participants also pointed out the advocacy role of institutions in the adoption of these practices by smallholders, which includes: better institutional coordination to manage climate risks in agriculture (among ministries and between the public and private sectors); strengthening of regulations concerning water conservation and use, seeds, and burning forests; public investments in infrastructure for agricultural production in general (dams, irrigation systems, drainage and sewage); capacity building at all levels (from farm to institutions) through the national system for technical assistance and extension services, among other mechanisms.

Phase III: Cost-Benefit Analysis of Prioritized CSA Options

Subsequently, a Cost-Benefit Analysis (CBA) was carried out for the eight practices prioritized in the previous phase. This analysis was based on a sample of 200 producers from the departments of Zacapa and Chiquimula (from the municipalities of San Diego, Huité, Cabañas, and Zacapa, in Zacapa, and Camotán, Jocotán, Olopa, and San Juan Ermita, in Chiquimula). These are two out of the ten departments with the highest number of acute malnutrition cases reported after the 2014 drought.

Economic and financial indicators were estimated, including implementation and maintenance costs, Net Present Value (NPV), Internal Rate of Return (IRR), and Payback Period (PP). The analysis of economic and financial indicators shown in Figure 2 identified the most profitable options for the producers in the region: the introduction of pest- and disease-tolerant bean varieties, as well as heat- and water stress-tolerant maize varieties, and crop rotation (given the positive NPV, an IRR higher than the rate of discount, and a short PP). However, half of the CSA practices analyzed take over four years to deliver the best economic results, which could become a limiting factor for vulnerable smallholders expecting changes in the short term (Sain et al, 2016).

As part of the CBA, positive or negative externalities were taken into consideration, regarding biodiversity conservation, maintenance or improvement of water and soil quality, and an increase in carbon capture.

Phase IV: Definition of CSA Portfolios

The results of the CBA analysis were disseminated in a second workshop held in June 2015, which sought to invite the same stakeholders attending the first meeting. The participants validated the results of the CBA and defined the practice portfolios to be promoted in the context of the Dry Corridor (Table 1), bearing in mind the objective set by stakeholders and taking into account the potential impact of practices on both CSA pillars and CBA indicators. Additionally, we mapped participant stakeholders and the possible ways in which they could support the implementation of CSA practices and we discussed the barriers and opportunities of their adoption.

In general, participants were interested in the fulfillment of food security and smallholder resilience (adaptation) objectives. CSA practices were selected and grouped in portfolios by participating sector (Table 1), taking into account different aspects.

- The delivery of potential benefits associated to the CSA pillars (productivity, adaptation, and mitigation) (Figure 7), based on the qualitative assessments of the indicators corresponding to each pillar (Figure 1).
- Low implementation and maintenance costs of CSA practices (Figure 3).
- Generation of additional income in connection to externalities and economic indicators (Figures 4-6).

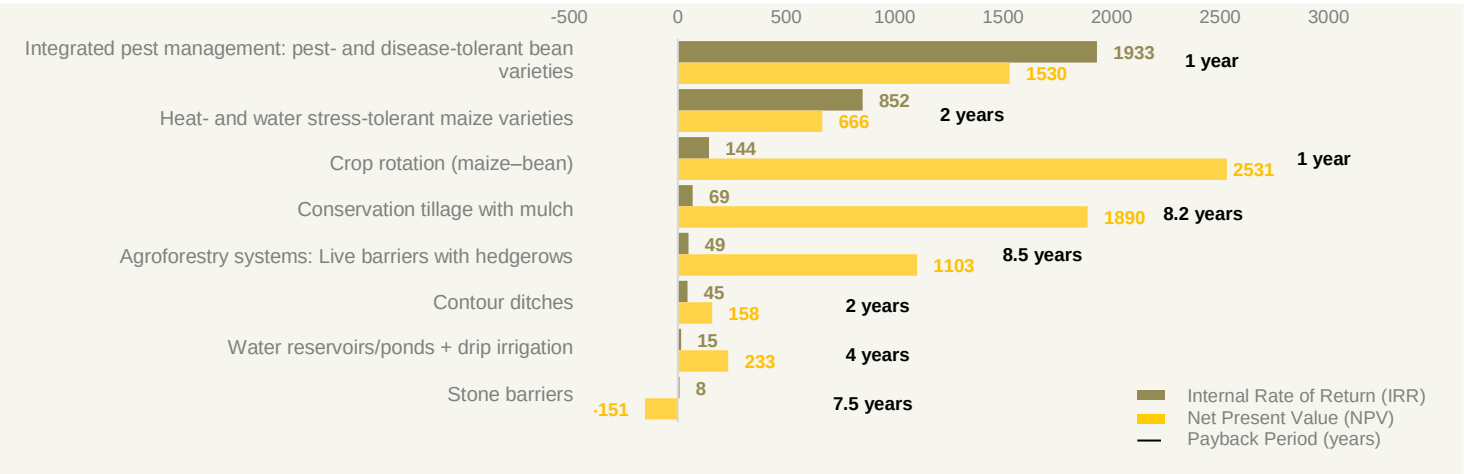

Figure 2. *Cost-benefit analysis: mean value for private profit indicators of CSA practices.*

Table 1. *Investment portfolios proposed by each sector*

	Producers, Representatives of NGOs	Academia & Research	National Government
Heat- and water stress-tolerant maize varieties	✓	✓	✓
Integrated pest management: pest- and disease-tolerant bean varieties	✓		✓
Agroforestry systems: Live barriers with hedgerows	✓		
Conservation tillage with mulch		✓	✓
Crop rotation (maize–bean)		✓	
Water reservoirs/ponds + drip irrigation			✓

The following figures show the performance of the three selected portfolios (P1, P2, and P3) with respect to CSA indicators (selected during Phase 1 and shown in Figure 1), profitability (implementation and maintenance costs [Figure 4], net present value [Figure 5], internal rate of return [Figure 6]), and the additional income from externalities (Figure 7).

Regarding the contribution to CSA indicators, little difference was observed among portfolios. However, the results show that soil and water conservation practices (conservation tillage and crop rotation) and the introduction of drought-tolerant varieties (included in the second portfolio) have greater benefits for productivity, as well as for adaptation and mitigation.

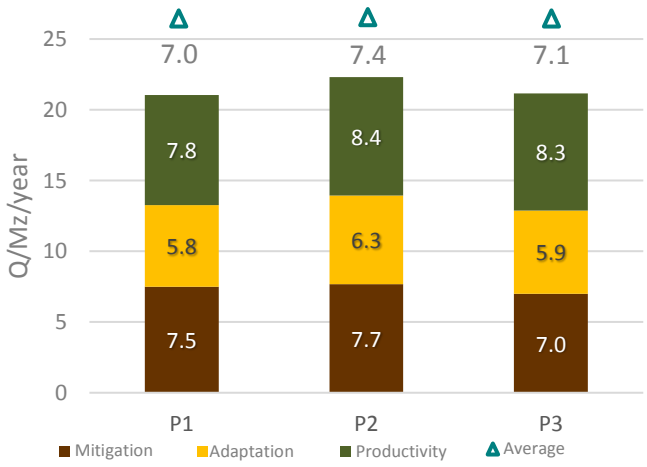

Figure 3. *Potential impact of CSA portfolios on CSA pillars Qualitative assessment by pillar: -10= highly negative impact; 0= no effect; 10= highly positive impact.*

The set of practices included in Portfolio 3 (improved maize and bean varieties, conservation tillage, and water reservoirs) has higher installation costs, compared to the other two portfolios; however, the maintenance cost of these practices stays below the maintenance costs of Portfolio 2.

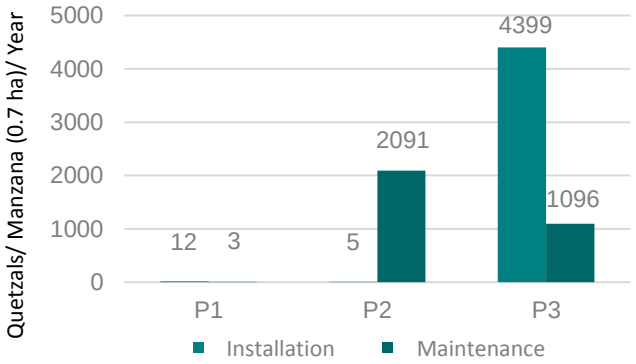

Figure 4. *Implementation and maintenance costs of the three selected CSA portfolios*

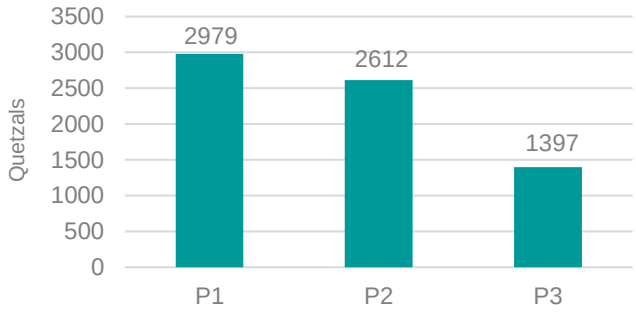

Figure 5. *Net Present Value (NPV)[1] of the three selected CSA portfolios*

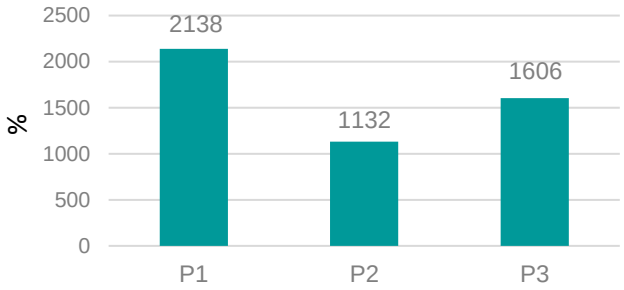

Figure 6. *Internal Rate of Return (IRR)[2] of the three selected CSA portfolios*

In terms of public benefits, it was found that the three investment options have the potential to contribute an additional income for maize and bean producers from the Dry Corridor. The set of practices included in Portfolio 1, prioritized by the group of producers and representatives of NGOs, can provide major economic benefits through the conservation of soil and water quality, biodiversity, and carbon capture (Figure 6).

[1] According to these indicators, the investment project can: be approved if Benefits>Costs; NPV>0; IRR>0 or be rejected if Benefits<Costs; NPV<0; IRR<0

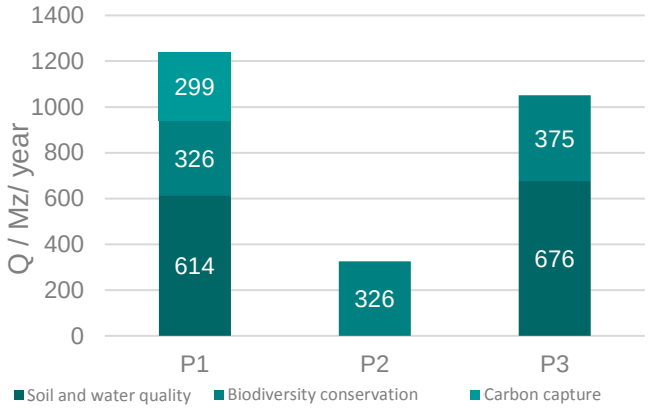

Figure 7. *Additional income from externalities of the three selected CSA portfolios*

CSA-PF and decision-making

Advancing efforts on CSA

The implementation of the CSA-PF made it possible to highlight the importance of the CSA concept in the conservation of the natural capital of farming families, allowing the reinforcement of a range of possibilities in terms of the practices comprising the programs implemented by MAGA, aimed at sustainable increasing productivity.

Based on the experience of this process, MAGA's position and interest was strengthened to support the statement of the Central American Agricultural Council (CAC, its Spanish initials) regarding the declaration of Placencia drawn up in the Ordinary Meeting of Heads of State and Governments from the Central American Integration System (SICA, its Spanish initials). In this regional context, the countries committed themselves to integrate efforts to address challenges posed by climate change and variability through common agendas, thus enhancing sustainable production under the concept of CSA.

Additionally, during the twenty-first Conference of the Parties (COP 21) in Paris, MAGA was appointed as the official voice of CAC, which gave it the opportunity to make a presentation and seek funding for CSA projects.

At the national level, MAGA has recently entered into a public-private partnership with the Guatemalan Chamber of Agriculture (CAMAGRO, its Spanish acronym), with clear and consistent objectives. This partnership will allow both institutions to advance a shared vision of advocating for the structural issues in which the CSA concept is based, such as food and nutritional security; adaptation; productive, environmental and social sustainability; restoring degraded land; and the integrated soil and water management, which are all fundamental aspects in the approach of the investment portfolios for the Dry Corridor.

Potential support form CSA-PF within the national political context

Prioritizing investments and setting up portfolios provides support to the National Policy on Integral Rural Development (PNDRI, its Spanish initials), particularly to the component related with the promotion of good agricultural practices, in which the interventions in the field are led by MAGA's National Rural Extension System (SNER, in Spanish), through Rural Development Learning Centers (CADER, in Spanish), which serves over 373,000 families across the national territory.

Such structure, in synergy with the possibility of setting up investment portfolios, becomes a valuable starting point to promote and provide guidance to projects and strategic alliances between cooperation organizations and MAGA. This will allow them to align their agendas and foster their work towards achieving a greater impact of the prioritization process in strategic areas, such as the expansion of the geographical scope and the quality of the assistance provided to smallholders, through the rural extension system.

Photo 2. *Women from the Chortí ethnic group in the municipality of Olopa, in the eastern Dry Corridor of Guatemala. J.L Urrea (CCAFS)*

Scaling up CSA initiatives in Guatemala

There are many barriers and opportunities in the process of scaling up CSA initiatives. This is why an important consideration is drawing up a management strategy well-coordinated among the different organizations at the local, national, and international level, to provide smallholder families with a continuous assistance process that is sustainable in the long term.

This requires strengthening the platforms existing in the region and building the convening capacity and empowerment of stakeholders, from families and groups of smallholder indigenous farmers (Figure 9) through international cooperation agencies. All this is done with the purpose of avoiding isolated work among stakeholders and drawing up joint agendas to implement the necessary actions and strategies to achieve common objectives.

By organizing and strengthening the human potential present in the territory, the sustainable use of current and future natural and economic resources comes into play, evidencing key entry points to be targeted by portfolios of CSA-practices, which would ensure sustainable livelihoods for farmers.

This is where the need to shape a sound extension system becomes relevant, as it must consider local issues and priority solutions to maximize positive impacts of agricultural practices and technologies on the communities' capacities to produce, adapt, and, if possible, mitigate climate change, thus having greater chance of success in managing their territories.

Every action carried out by MAGA, once acknowledged and validated by central government, will favor the appropriation of working strategies to achieve smoother and more targeted processes for decision-making, dissemination of information, and directing investments of economic resources, which will operationalize the CSA-PF portfolios in the different territories, with support from the National Rural Extension System.

Conclusions

The application of the CSA-PF in Guatemala was aligned with government and non-government efforts to respond to the severe drought affecting the Dry Corridor in 2014. The process allowed acknowledging and integrating a range of social and political stakeholders at different levels, who took part in a participatory process and provided joint and concrete solutions to current and future climate challenges facing maize and bean producers.

It was emphasized that it is important to conduct a multi-dimensional analysis of CSA investments, which should understand and include the analysis of social, institutional, and environmental factors that could hinder the adoption of CSA practices. This is the case of issues related to land tenure undermining access to credit and other long-term investments in plots. Good acquaintance with the social and institutional environment, as well as with the barriers and opportunities to the adoption of practices and sets of practices, constitutes a key aspect in the prioritization of investments at the farm level, which would have to reflect the synergies among the proposed productivity, adoption, and mitigation objectives.

The CSA portfolios built by different stakeholders in Guatemala do not constitute definite solutions in the face of droughts threatening thousands of families in the Dry Corridor, but they rather offer a range of possibilities that take into account multiple criteria and dimensions responding to the different needs of participant stakeholders, and they set the necessary methods and tools to be able to adapt or expand results to other agro-ecological contexts in a way that they are affordable and profitable for farmers, from different points of view.

To a large extent, the success of the CSA-PF lies in the commitment and participation of all involved stakeholders and their will to contribute to the process, from an economic, social, technical-scientific, and political-institutional standpoint. This will make it possible to create an enabling environment, where the potential of CSA portfolios to influence policies and strategies of the national agricultural sector can be effectively harnessed.

Further Reading

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The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is a strategic partnership of CGIAR and Future Earth, led by the International Center for Tropical Agriculture (CIAT). CCAFS brings together the world's best researchers in agricultural science, development research, climate science and Earth System science, to identify and address the most important interactions, synergies and tradeoffs between climate change, agriculture and food security.

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